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Emergency medicine is a specialty which closely reflects societal challenges and consequences of public policy decisions. The emergency department specifically deals with social injustice, health and economic disparities, violence, substance abuse, and disaster preparedness and response. This journal focuses on how emergency care affects the health of the community and population, and conversely, how these societal challenges affect the composition of the patient population who seek care in the emergency department. The development of better systems to provide emergency care, including technology solutions, is critical to enhancing population health.

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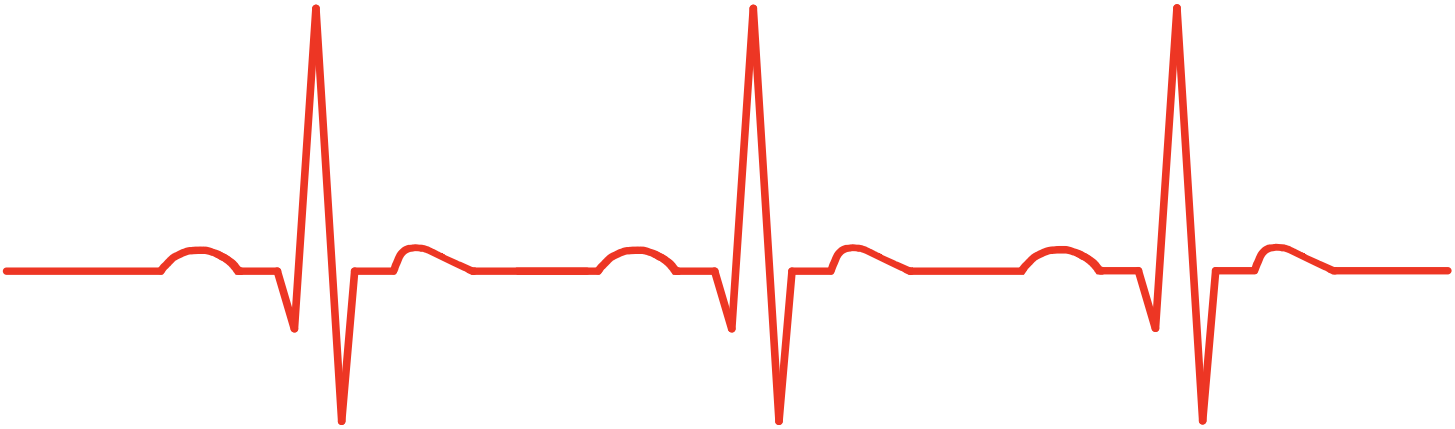

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CPCEM Clinical Practice & Cases

Cultural Humility Curriculum to Address Healthcare Disparities for Emergency Medicine Residents

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Introduction: Emergency medicine (EM) residency programs have variable approaches to educating residents on recognizing and managing healthcare disparities. We hypothesized that our curriculum with resident-presented lectures would increase residents' sense of cultural humility and ability to identify vulnerable populations.

Methods: At a single-site, four-year EM residency program with 16 residents per year, we designed a curriculum intervention from 2019-2021 where all second-year residents selected one healthcare disparity topic and gave a 15-minute presentation overviewing the disparity, describing local resources, and facilitating a group discussion. We conducted a prospective observational study to assess the impact of the curriculum by electronically surveying all current residents before and after the curriculum intervention. We measured attitudes on cultural humility and ability to identify healthcare disparities among a variety of patient characteristics (race, gender, weight, insurance, sexual orientation, language, ability, etc). Statistical comparisons of mean responses were calculated using the Mann-Whitney U test for ordinal data.

Results: A total of 32 residents gave presentations that covered a broad range of vulnerable patient populations including those that identify as Black, migrant farm workers, transgender, and deaf. The overall survey response was 38/64 (59.4%) pre-intervention and 43/64 (67.2%) post-intervention. Improvements were seen in resident self-reported cultural humility as measured by their responsibility to learn (mean responses of 4.73 vs 4.17; $P < 0.001$) and responsibility to be aware of different cultures (mean responses of 4.89 vs 4.42; $P < 0.001$). Residents reported an increased awareness that patients are treated differently in the healthcare system based on their race ($P < 0.001$) and gender ($P < 0.001$). All other domains queried, although not statistically significant, demonstrated a similar trend.

Conclusion: This study demonstrates increased resident willingness to engage in cultural humility and the feasibility of resident near-peer teaching on a breadth of vulnerable patient populations seen in their clinical environment. Future studies may query the impact this curriculum has on resident clinical decision-making. [West J Emerg Med. 2023;24(2)119–126.]

INTRODUCTION

The healthcare of vulnerable populations disproportionately falls to the emergency department (ED), which has become the safety net for many local communities.[1] When patients access care through the ED, they often encounter emergency medicine (EM) trainees as a part of their care team. To provide equitable care it is important for EM trainees to understand that healthcare inequities and social determinants of health impact the diverse populations that they will encounter while working in the ED. While most agree that knowledge about cultural issues is important when providing clinical care, many trainees feel unprepared and unequipped to address the social needs of the populations they serve.[2]

The Accreditation Council for Graduate Medical Education (ACGME) Common Program Requirements include trainee recognition and management of healthcare disparities through the domains of interpersonal and communication skills, systems-based practice, and quality improvement.[3] The ACGME's 2018 Clinical Learning Environment Report (CLER) highlighted that "across most clinical learning environments, formal education and training on cultural competency did not address the specific populations served by the institution."[4] Additionally, the report noted that programs with a healthcare disparities curriculum focused on generic experiences and did not address the specific populations served by the physicians in those institutions.

Despite this call to action, there is little information about how to help trainees recognize the breadth of disparities that they encounter at the bedside.[5] Anecdotally, healthcare disparities in the medical education curriculum are taught as long-form lectures with PowerPoint presentations, typically with an expert as the teacher. This passive approach comes with challenges including lack of learner engagement and difficulty achieving desired educational objectives and outcomes.[6] Alternate strategies include community-based efforts, simulation, and case-based learning. However, these approaches are time- and resource-intensive and therefore not possible for many training programs.

The approach to addressing health disparities and social determinants of health in medical training programs has largely focused on teaching cultural competency. While cultural competency focuses on delivering quality care to patients with diverse beliefs, attitudes, values, and behaviors it has also been criticized as being one dimensional, promoting finite knowledge, and having a discrete endpoint.[7-9] The framework of cultural humility is an alternative approach. As defined by Tervalon and Murray-Gargia, cultural humility is "a lifelong commitment to self-evaluation and self-critique, to redressing the power imbalances in the patient-physician dynamic, and to developing mutually beneficial and non-paternalistic clinical and advocacy partnerships with communities on behalf of individuals and defined populations."[10] Cultural humility emphasizes a growth mindset with a lifelong dynamic process of self-reflection.

Population Health Research Capsule

What do we already know about this issue?
Emergency medicine residency programs have variable approaches to educating residents on recognizing and managing healthcare disparities.

What was the research question?
Can residents identify vulnerable patient populations and use cultural humility in a resident-led lecture to address healthcare disparities?

What was the major finding of the study?
Residents demonstrated increased cultural humility ($P < 0.001$) and awareness of patient bias due to race and gender ($P < 0.001$).

How does this improve population health?
The long-term desired outcome is for residents to address biases in healthcare delivery and reduce disparities through equitable patient care.

Previous studies describing cultural humility curricula with family medicine residents, pediatric residents, physical therapy students, and medical students have shown positive results.[11-14] As described in those studies, cultural humility is taught through instructor-led presentations, and cases are drawn from simulation, patient panels, or home visits. Our study introduces a novel healthcare disparities curriculum based on resident-led presentations, drawn from their own clinical encounters, that encourage the practice of self-directed learning and cultural humility. Our first hypothesis was that a resident-led lecture series that sought to address patients' social needs within their local community would increase residents' appreciation for cultural humility. Our second hypothesis was that residents are capable of identifying patient populations that experience healthcare disparities from the community that they serve in their ED.

METHODS

Study Design

This prospective observational study from July 1, 2019–June 30, 2021 examines the impact of a curriculum intervention on EM residents' appreciation for cultural humility and attitudes toward healthcare disparities over two academic years by administering a pre- and post-intervention,

self-reported survey. This study was deemed exempt by the University of Michigan IRB (HUM 00164660).

Population

Participants in this study were EM residents in a single, four-year EM residency program with 16 residents per year. These residents rotate at three core training sites: a tertiary care academic ED; a small city community ED; and an urban county ED. At this program, EM residency didactics are held once weekly. All residents are required to attend at least 70% of the sessions.

Curricular Design

We used Kern's six-step model for medical education curriculum development.[15] We used the ACGME CLER report and annual program review as our general needs assessment. A specific-needs assessment electronic survey was deployed to current residents to identify specific knowledge and skills gaps. We identified four barriers to asking patients about their social needs: 1) fear of threatening the doctor/patient relationship; 2) lack of knowledge of the resources available to patients; 3) lack of knowledge of the community they serve; and 4) limited time with the patient in an ED encounter.

Following this initial survey, we designed a novel longitudinal curriculum integrated into the existing weekly EM residency didactic structure. We proposed a case-based, near-peer teaching curriculum (ie, learner as teacher) and centered our curriculum on junior residents as content developers and presenters. As part of our intervention, in the spring each rising second-year resident was required to sign up to give a 15-minute presentation on healthcare disparities in the upcoming academic year. A total of 16 15-minute lectures were scheduled for each year.

Prior to the start of each academic year, rising second-year residents were given a document outlining the background and objectives for the lecture series (Appendix 1). The learner-teachers were asked to 1) briefly describe a patient encounter where observed inequities challenged the statement, "Quality care is equitable care"; 2) describe how to increase awareness of patients at risk for disparate care; and 3) provide actionable information on at least one institutional, community, or state resource that could be used to address the observed barrier. During their presentation, residents were expected to provide a brief overview of the disparity and available local resources, and to conclude with a facilitated group discussion. A running list of previous lecture topics was provided. While repeating a similar topic was not prohibited, residents were instructed to focus on a unique intersectional perspective to avoid duplication.

From July 2019–February 2020, all presentations were given in person. Like all other resident didactics, the format was switched to an online virtual format in March 2020 as a result of the coronavirus 2019 pandemic. The lectures were temporally spaced to allow integration of healthcare disparities topics into the broader curriculum and to avoid isolating these talks on a specific day. We felt it was important to emphasize that education on healthcare disparities had equal importance to education on clinical and scientific topics within the field of EM. During the first year of implementation, residents were scheduled to present on different weeks. To smooth the scheduling demands, the following year the lectures were scheduled in pairs.

Assessment

We assessed the impact of the curriculum via a pre- (June 2019) and post- (June 2021) online survey tool (Qualtrics XM, Provo, UT) that measured residents' attitudes on cultural humility and their ability to identify healthcare disparities among a variety of patient characteristics (race, gender, weight, insurance, sexual orientation, language, ability, etc) (Appendix 2). All 64 current residents at each time point — at the time of study implementation and at the conclusion of the assessment — were invited to complete the surveys. To maintain respondents' anonymity, we did not collect their demographics.

To maximize internal validity and minimize self-report bias, we created the survey by combining questions from two previously validated and published studies that were then reviewed by a group of EM medical education experts prior to survey administration.[16,17] Questions were selected by study authors with content expertise to reflect the aims of the study hypothesis. One set of questions was used to measure their cultural humility by asking residents about their cultural awareness, attitudes, and behaviors using a five-item Likert scale. Another set of questions asked residents about their perceptions of the differences in care patients received in the ED based on their identities, using a four-item scale of 0-25% of the time through 75-100% of the time. Lastly, in the post-implementation survey, additional questions were included for formal evaluation and assessment of the curriculum and to allow for narrative feedback. We reviewed this feedback for themes and have included representative narratives in the discussion.

Analysis

We performed statistical comparisons of mean responses using Student's *t*-test, and did comparisons between pre- and post-intervention survey response distributions using the Mann-Whitney U test (also known as the Wilcoxon rank-sum test) for unpaired ordinal data. All data cleaning and statistical analysis was done using R (The R Foundation for Statistical Computing, Indianapolis, IN).[18] We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for this observational study.[19]

RESULTS

From 2019 to 2021, 32/32 (100%) second-year residents presented on 28 unique healthcare disparities topics covering a broad range of vulnerable patient populations (Table 1). During the two-year study period,

16/24 (66%) months had at least one resident presentation scheduled for the lecture series. The overall survey response rate was 38/64 (59.4%) pre-intervention and 43/64 (67.2%) post-intervention (Table 2). Responses were obtained from residents at all levels of training.

Questions about cultural humility, specifically cultural attitudes and behavior, that had higher rates of self-reported behavior following the curriculum intervention include "I ask patients to tell me about their own explanations of illness" (P=0.030); "I adapt my care to patient's preferences" (P=0.030); "I welcome feedback from co-workers about how to relate to patients from different cultures" (P=0.009); "I have the responsibility to learn about all the different groups of people that make up society" (P<0.001); and "I should be aware of the different cultures that exist within my practice" (P<0.001) (Figure 1). Residents reported a statistically significant increase in concern that patients are treated differently in the healthcare system based on their race (P < 0.001) and gender (P < 0.001) (Figure 2). The remaining survey questions, although not statistically significant at the 5% level, trended in a similar direction (Appendix 3).

At the end of the study period, 38 of 42 residents (90.5%) reported that the lecture series had changed their approach to caring for patient populations who are marginalized, 30 (71.4%) reported increased knowledge with regard to caring for patient populations who are marginalized, 30 (71.4%) reported increased awareness of their current knowledge gaps in caring for patient populations who are marginalized, and 26 (54.2%) reported an increased desire to learn more about caring for patient who are marginalized.

We also obtained qualitative feedback regarding the curriculum design, and representative comments are included below.

Representative Positive Comments:

"It was great to see so many different topics presented.

Table 1. Lecture titles. Second-year residents presented 32 lectures between 2019–2021, covering 28 unique topics.

Advocating for Incarcerated Populations	Healthcare Disparities in Athletes
Alcohol Use	Health Literacy
Alcohol Use Disorder *	Housing Insecurity
Amish Healthcare	Identifying Sex Trafficking in the Emergency Department
Care of Patients with Sickle Cell Disease	Immigrant and Latino Healthcare/Border Medicine
Caring for Incarcerated Patients *	Mental Health and Minorities
Coronavirus Disease 19 Healthcare Disparities	Migrant Farmworkers
Coronavirus Disease 19-Related Inequities *	Non-English Speaking Patients and Interpreters
Culture Differences in Pain Expression and Emergency Department Pain Management	Patient requesting Clinician Based on Bias
Deaf/Hard-of-hearing Health Challenges in the Time of Coronavirus Disease 19	Patients Boarding with Inpatient Psychiatric Needs
Disparities in Clinical Trials	Race and Pain Management
Disparities in Psychiatric Care	Rural Health Disparities
Disparities in Trauma	Social Isolation
Financial Barriers	Transgender Care
Food Insecurity	Transgender Health *
Healthcare Disparities Among Refugee Populations	Transportation

*Repeated topics.

Table 2. Resident survey response rates by postgraduate training year during each phase of the study

	Overall	Pre-intervention survey	Post-intervention survey
n	84	40	44
First year (Intern)	27 (32.5)	14 (35.0)	13 (30.2)
Second year	20 (24.1)	12 (30.0)	8 (18.6)
Third year	22 (26.5)	11 (27.5)	11 (25.6)
Fourth year	14 (16.9)	3 (7.5)	11 (25.6)

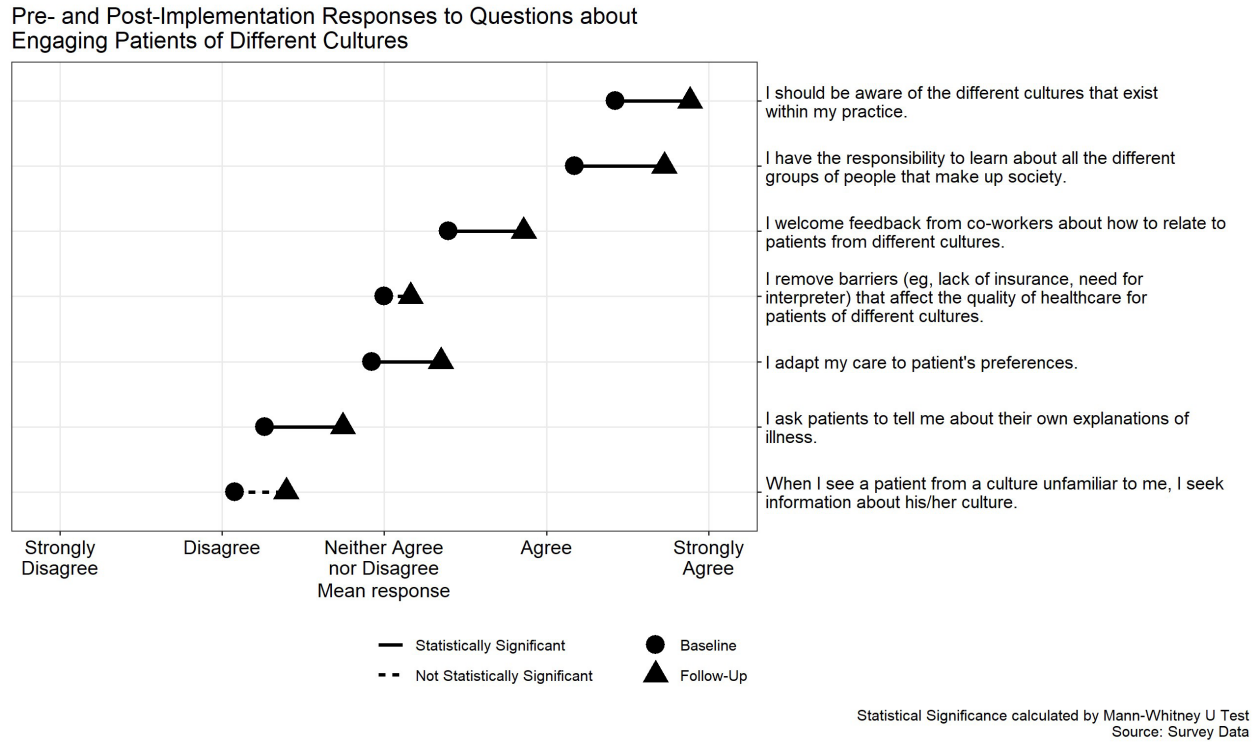

Figure 1. Measurement of cultural humility pre- and post- implementation responses.

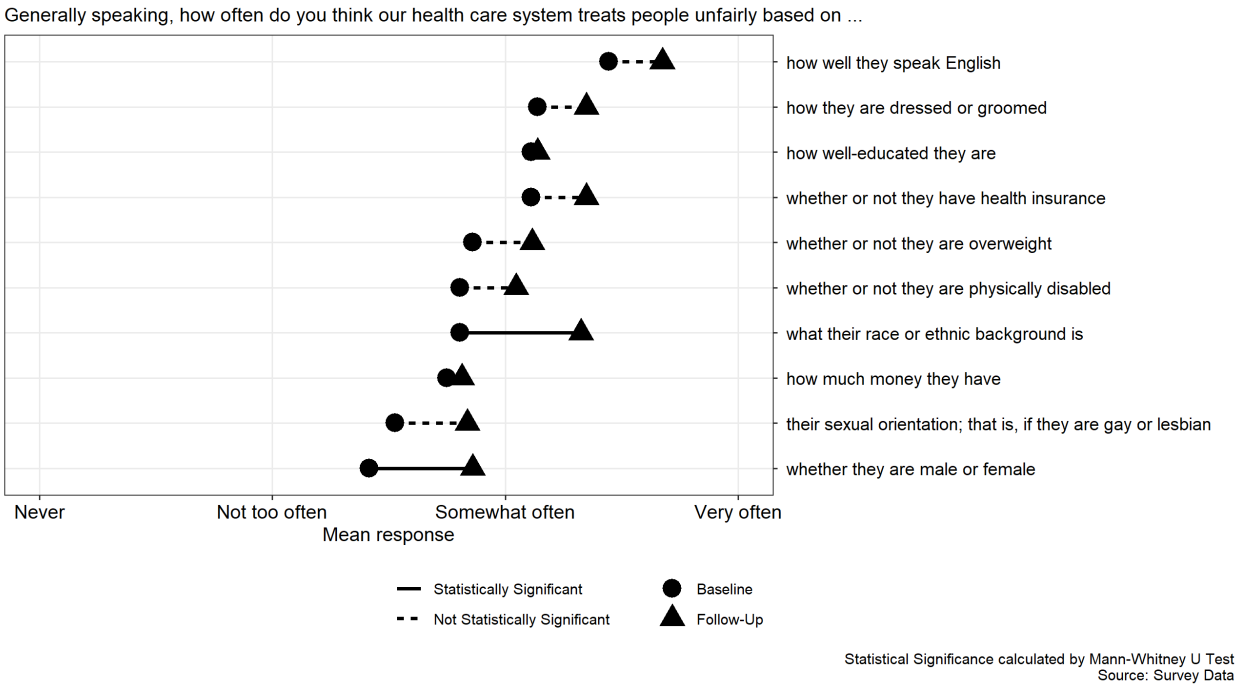

Figure 2. Rate of recognizing healthcare disparities pre- and post- implementation responses.

Each presentation included literature or resources that I wasn't previously aware of."

"I felt like I learned pertinent information from these lectures, and it made me proud of my program for actively teaching about these topics."

"I learned a lot from my classmates."

"I am glad this was added into conference."

"[It was] helpful to illuminate ongoing disparities in a multitude of areas and domains."

Representative Critical Comments:

> Some of the lectures definitely could have used more polish and have been better prepared ahead of time, I think lecture quality undermined some of the points - a Zoom lecture has to be fantastic to grab and hold attention; otherwise it gets ignored.
>
> "As many of the higher yield topics are presented, [it is] harder to come up with a good topic."
>
> "Changing the lecture series to a different format (sim/ community outreach) could also be interesting."
>
> "I think it would benefit from… few larger lectures, rather than 16, 15-minute lectures [per year]."

DISCUSSION

In this two-year longitudinal didactic curriculum, second-year EM residents at a four-year academic EM program led self-reflective discussions on healthcare disparities to engage peers on patient encounters in their clinical learning environment. As compared to pre-intervention, residents reported an increased desire to learn about patients at risk for healthcare disparities and a change in their approach to improve care for patients marginalized in the healthcare system. This finding suggests an increase in residents' sense of cultural humility, as the lectures spurred their interest to address knowledge gaps related to these patients. Residents identified a wide range of topics and were able to identify many unique cases where patients were marginalized by the healthcare system.

Importantly, these topics were identified by residents without specific topic selection a priori. We noted a correlation between the curriculum intervention and resident recognition of racial and gender disparities experienced by their patients. A similar increase in recognizing disparities was seen among all historically marginalized groups queried. The statistical differences noted for racial and gender disparities may have been due to their relative frequency in the clinical context. Additionally, these identities may be more readily apparent in clinical encounters compared to an individual's income, level of education, or sexual orientation.

We designed and implemented a unique curriculum that encourages residents to use the fundamentals of cultural humility, rather than cultural competency, to promote learner-directed didactics and introspection. There is a consistent trend away from cultural competency and toward cultural humility.[7,8] Lekas et al emphasizes that training in cultural competency risks stereotyping, stigmatizing, and "othering" of patients and offers little acknowledgment of the intersectionality of multiple marginalized identities. The authors argue that physicians should instead be trained in cultural humility, which focuses on self-reflection, is more patient-centered, addresses a physician's openness to share power with the patient, and emphasizes the goal of learning continuously from their patients.

Anger et al discusses the theoretical differences between cultural humility and cultural competency and underscores the value of shifting to cultural humility. Uniquely, the emphasis on self-reflection in cultural humility facilitates learners to explore their unconscious and conscious biases. Recently, the Association of American Medical Colleges released competencies on diversity, equity, and inclusion that specifically include assessing the practice of cultural humility.[20] Additionally, the ACGME has begun to explore the incorporation of cultural humility into residency education as evidenced by the creation of the Pursuing Excellence Health Care Disparities Collaborative.[21] The goals of this initiative include cultural humility, social determinants of health, and quality improvement.

One study surveying EM residency program directors found that approximately two-thirds of responding programs had cultural competency as part of their curriculum.[22] Similar to what was reported by the ACGME, over 90% of these curricula used generic structured didactics with a focus on race and ethnic disparities. Those authors identified notable gaps in incorporating additional healthcare disparities such as limited English proficiency, gender identity and sexual orientation, and social determinants of health. In a recent study by Ward-Gaines et al, EM residents were exposed to various health equity topics using simulation immersion.[23] Residents reported a greater understanding of various healthcare disparities. While their study described cultural competency outcomes, the authors discussed the importance of self-reflection – a key tenet of cultural humility.

Our study is the first to show how an EM residency can incorporate cultural humility into its didactic curriculum. One important outcome of our curriculum is that residents are exposed to a wide range of topics not limited to race and ethnicity. Residents selected patient populations with disparities defined by social isolation, immigration, incarceration, sexual orientation, language, deafness, and mental health. We believe that this cultural humility-based healthcare disparities curriculum in EM residency programs is a feasible approach that can be implemented into existing didactic structures.

An important feature of our curriculum is the focus on cultural humility, specifically self-reflection and lifelong learning. Residents were encouraged to select clinical encounters where a social determinant of health was a potential barrier to care. They presented the clinical case, and ways to overcome the barriers, to their peers and faculty in a flipped classroom style — with the learner as a teacher. Importantly, the case-based model encouraged critical self-reflection as trainees were asked to share real-life episodes of unequal care encountered during their clinical shifts. In addition, they were tasked with discovering and sharing local resources that could be brought to the bedside to address

patients' needs in the ED and upon discharge (eg, how to get a peer-recovery coach to come to the ED to counsel and support a post-overdose patient; how to access the local food pantries; how to ask about pronouns when caring for transgender individuals; what local advocacy groups support youth in crisis; etc). After participating in the curriculum, residents reported increased awareness of and concern for individuals marginalized within the healthcare system. While the statistical significance varied in each domain, the trend of increasing concern over time was consistent. In addition, resident responses also revealed increased awareness of their knowledge gaps and a desire to learn more about populations that are marginalized. This is consistent with the goal of cultural humility as a lifelong and dynamic process.

Collectively, these are important skills for emergency physicians to have throughout their career. Emergency physicians may work in various practice settings and are exposed to innumerable cultural customs and changing patient demographics. It is not feasible to achieve a "competency" that is individualized to every patient. An emphasis of learning from the individual patient and self-reflection provides a unique advantage of cultural humility over cultural competency. Future studies may assess this impact through measuring encounter-level outcomes such as resource utilization, connection to community resources, or ED return visits. We have adapted our own healthcare disparities curriculum to encourage more engagement with ED-based operational metrics as stratified by various patient demographics.[24]

LIMITATIONS

This was an observational study without a control group to assess the impact that time had over the two-year study period. Statistical analysis was limited by a small sample size precluding any subset analysis by residency cohort. Individual-level impact was not assessed as respondent identifiers were not recorded. Changes in behavior were self-reported, and we did not assess change in care delivery. It is possible that some differences in responses of our pre- and post- implementation survey were due to increased awareness of healthcare disparities from COVID-19 and the increased recognition of structural racism in the United States that was highlighted by the disproportionate incidence of mortality in Black patients.[25]

Additionally, our curriculum was designed and initially implemented roughly nine months before the regional impact of COVID-19 required that all educational content to be converted from in person to a virtual format. Anecdotally, the switch to virtual format led to a tendency for more time to be filled with presentations, which left less time available for discussion. We anticipate that had this transition not occurred, the curriculum would have had a greater impact.

CONCLUSION

This resident-driven lecture series empowered learners to identify and present on healthcare disparities relevant to their clinical learning environment. Over the study period, residents were encouraged to engage as lifelong learners. Residents demonstrated growth in cultural humility through self-reflection and lifelong learning, and they gained a greater appreciation for existing healthcare disparities. We believe future curricula should reinforce a longitudinal, integrated approach, and attempt to assess curriculum impact on direct patient care.

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Impact of COVID-19 Pandemic on Food Insecurity in an Urban Emergency Department Patient Population

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Introduction: Food insecurity (FI) has been associated with adverse health outcomes and increased healthcare expenditures. Many families experienced reduced access to food during the coronavirus disease 2019 (COVID-19) pandemic. A 2019 study revealed that the pre-pandemic prevalence of FI at an urban, tertiary care hospital's emergency department (ED) was 35.3%. We sought to evaluate whether the prevalence of FI in the same ED patient population increased during the COVID-19 pandemic.

Methods: We performed a single-center, observational, survey-based study. Surveys assessing for FI were administered to clinically stable patients presenting to the ED over 25 consecutive weekdays from November–December 2020.

Results: Of 777 eligible patients, 379 (48.8%) were enrolled; 158 (41.7%) screened positive for FI. During the pandemic, there was a 18.1% relative increase (or 6.4% absolute increase) in the prevalence of FI in this population (P=0.040; OR=1.309, 95% CI 1.012-1.693). The majority (52.9%) of food-insecure subjects reported reduced access to food due to the pandemic. The most common perceived barriers to access to food were reduced food availability at grocery stores (31%), social distancing guidelines (26.5%), and reduced income (19.6%).

Conclusion: Our findings suggest that nearly half of the clinically stable patients who presented to our urban ED during the pandemic experienced food insecurity. The prevalence of FI in our hospital's ED patient population increased by 6.4% during the pandemic. Emergency physicians should be aware of rising FI in their patient population so that they may better support patients who must choose between purchasing food and purchasing prescribed medications.
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INTRODUCTION

The Life Sciences Research Office defines food insecurity (FI) as existing "whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain."[1] In 2016, 41 million Americans lived in food-insecure households.[2] Adults experiencing FI have greater rates of office visit use, inpatient hospital stays, and emergency department (ED) visits.[3,4] Reducing FI may lower healthcare service utilization and spending during major health crises.[4]

Food insecurity has also been shown to increase the risk of chronic disease, placing individuals at enhanced risk for complications due to COVID-19 infection.[5] A recent study conducted by McDonough et al before the COVID-19 outbreak discovered that 35.3% of our urban teaching hospital's ED patient population at MedStar Washington Hospital Center (MWHC) experienced FI.[6] Screening for FI during the pandemic is an important first step in identifying the populations that are at highest risk of experiencing worse health outcomes. This data can be further used to direct healthcare spending during a crisis.

Globally, COVID-19 made access to staple foods and availability of fresh produce more challenging.[7] Financially insecure families relied on complicated food purchasing methods and FI coping strategies. For example, many destitute households needed to travel long distances to acquire affordable food products. These families depended heavily on public transport and rideshare programs, both of which became risky modes of transportation during the pandemic. Additionally, during the outbreak, social distancing guidelines made sharing meals with family difficult, as well as made group meals at senior homes and soup kitchens nearly impossible.[8] Furthermore, at the start of the pandemic, there was an upsurge in panic-buying, during which many families stockpiled food and supplies. This led to market shortages and rising prices.[9] An increased incidence of food hoarding negatively affected low-income individuals' access to food since these individuals lacked the financial means to buy products in bulk.[8]

The prevalence of FI and hunger in the ED population has historically been higher than among the general public.[2,10] Therefore, the ED environment represents a unique opportunity for physicians to identify patients with FI. Our goal in this study was to assess the impact of the COVID-19 pandemic on the prevalence of FI in the ED patient population. We hypothesized that the prevalence of FI in the ED patient population significantly increased during the pandemic.

Population Health Research Capsule

What do we already know about this issue?
Food insecurity (FI) is associated with poor health outcomes. Many families had reduced access to food during the COVID-19 pandemic.

What was the research question?
Did the prevalence of FI among emergency department (ED) patients increase during the COVID-19 pandemic?

What was the major finding of the study?
The prevalence of FI in ED patients increased by 6.4% (absolute) and 18.1% (relative) during the COVID-19 pandemic (P=0.040, 95% CI 1.012-1.693).

How does this improve population health?
By raising awareness of rising FI during the pandemic, our research may support increased funding for food banks and food pharmacies during global health crises.

METHODS

Study Design

We conducted a single-center, observational, survey-based study in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Guidelines.[11] The study protocol was reviewed and approved by the MedStar Health Research Institute Institutional Review Board. Subjects were enrolled from October 26–December 2, 2020 between the hours of 8 AM–8 PM Monday through Friday (excluding November 26, 27, and 30 due to the Thanksgiving holiday) at an urban, adult, tertiary care teaching hospital ED with approximately 90,000 annual visits. In the pre-pandemic study, subjects were enrolled from November to December 2019 between the hours of 8 AM–8 PM Monday through Friday in the same hospital ED.

All clinically stable adult ED patients were approached by trained research assistants (RA). Verbal consent was chosen to minimize direct contact and exchange of materials between participants and study personnel during the pandemic and to reduce participation bias. Consenting participants were provided with an information sheet detailing their involvement in the study. Non-English speakers, patients presenting with altered mental status, clinically unstable patients, prisoners or patients in police custody, and patients <18 years were excluded from the study.

Procedures for Data Collection

Research assistants used the electronic health records (EHR) to identify patients who met all inclusion and exclusion criteria and approached participants after they were seen by the treating clinician and prior to their disposition. After describing the study, RAs verbally administered a survey at the bedside of consenting participants.

The first two survey questions were taken from the previously validated Hunger Vital Sign screening tool for FI: 1) "Within the past 12 months, we worried whether our food would run out before we got money to buy more"; and 2) "Within the past 12 months, the food we bought just didn't last and we didn't have money to get more."[12] A response from the patient of "often true" or "sometimes true" to either question was categorized as a positive screen for FI, and the subject was subsequently provided a handout of community resources.[12] To ascertain whether FI was influenced directly by the pandemic, we created the following additional questions: 3) "Has the COVID-19 pandemic changed your access to food?" and 4) "Which of the following factors reduced your access to food during the COVID-19 pandemic?" Lastly, we asked for the following socioeconomic variables: living situation; highest education level; employment; and household annual income. The only difference between the study designs for the pre-pandemic and intra-pandemic studies was that survey questions #3 and #4 were not included in the pre-pandemic study survey.

Using the EHR, we collected the following baseline characteristics: age; gender; race/ethnicity; weight; height, body mass index; pre-existing comorbid conditions; medication use for comorbid conditions; and history of substance use. Vital signs at presentation were used to screen for clinical stability. A de-identified log with no protected health information was kept to account for every patient who presented to the ED during the study period. We collected and managed study data on a secure tablet using REDCap electronic data capture tools hosted at MedStar Health.

Of note, our study design was nearly identical to that of McDonough et al.[6] The only difference in our data collection methods was that the McDonough study took place in late 2019 (before the pandemic), while our study took place exactly one year later in late 2020 (during the pandemic).

Data Analysis

The primary outcome of our study was the prevalence of FI in the ED patient population during the COVID-19 pandemic. Secondary outcomes included 1) the percentage of ED patients reporting reduced access to food due to the COVID-19 pandemic, and 2) patient-perceived barriers to accessing food during the COVID-19 pandemic. We evaluated patient characteristics with descriptive statistics and frequency distributions. Categorical traits were compared using the chi-square test or Fisher's exact test. We compared continuous traits using the independent samples *t*-test or Wilcoxon rank-sum test. Statistical analysis was performed with SPSS 26 (IBM Corp, Armonk, NY).

Vocabulary

In the remainder of this paper, McDonough et al's 2019 study is referred to as the pre-pandemic study, while our 2020 study is referred to as the intra-pandemic study.

RESULTS

Enrollment and Patient Characteristics in the Intra-pandemic Study

In total, 2,667 patients were screened for the study. Of those, 1,890 did not meet study criteria. Of the 777 eligible visits, 398 patients declined participation, resulting in a cohort of 379 (48.7%) participants (Figure 1). The characteristics of the study participants are presented in Table 1.

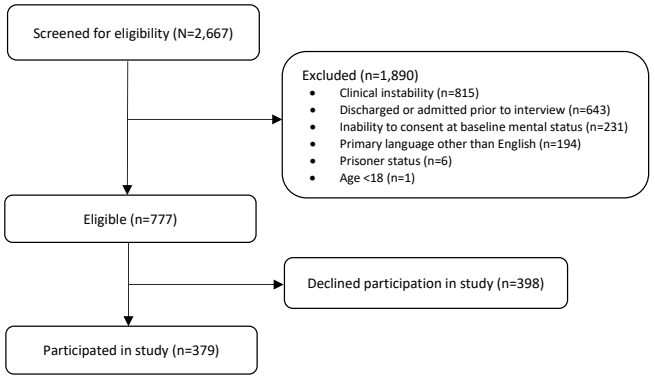

Figure 1. Participant enrollment in intra-pandemic study.

Table 1. Patient characteristics in intra-pandemic study.

Characteristic	Food-insecure n=158 (41.7%)	Non-food insecure n=221 (58.3%)	P-value
Average age	48.5	51.8	>0.05
% Female	57.7%	51.1%	0.139
Race			<0.01
Black	135	161	
White	5	41	
Hispanic/Latinx	10	9	
Other	6	12	
Household situation			<0.01
Own	12	60	
Rent	89	96	
Live with family	46	56	
Senior home	1	3	
Senior nursing facility	0	1	
Undomiciled	7	2	
Declined to state	3	2	
Highest education level			<0.01
High School/GED	92	75	
Some college	31	56	
Associates	6	11	

Table 1 Continued. Patient characteristics in intra-pandemic study.

Characteristic	Food-insecure n=158 (41.7%)	Non-food insecure n=221 (58.3%)	P-value
Highest education level			
Bachelors	6	36	
Masters/Doctorate	5	38	
Trade/ Apprenticeship	8	5	
Declined to state	7	0	
Employment			<0.01
Full-time	33	104	
Part-time	16	16	
Unemployed	65	36	
Disabled	23	18	
Retired	20	44	
Declined to state	0	2	
Household annual income			<0.01
<$12,490	43	23	
$12,490-$24,999	26	26	
$25,000-$49,999	29	30	
$50,000-$74,999	12	32	
$75,000-$99,999	0	24	
>$100,000	1	37	
Declined to state	43	51	
History of substance use	27%	17.3%	0.02
Average SBP	137.5	136.2	0.172
Average glucose level	131.8	121.7	0.756
Average BMI	31	30.2	0.329
Past medical history of:			
Hypertension	40.4%	40.8%	0.934
Hyperlipidemia	19.9%	20.2%	0.941
Diabetes mellitus	26.9%	19.7%	0.1
Coronary artery disease	11.5%	9%	0.412
Cancer	3.2%	5.8%	0.237
Obesity	43.6%	40.8%	0.589
On medications for:			
Hypertension	34.6%	32.7%	0.703
Hyperlipidemia	16.7%	17.5%	0.834
Diabetes mellitus	19.9%	14.8%	0.194
Coronary artery disease	16%	9.4%	0.053

GED, General Education Diploma; *BMI*, body mass index; *SBP*, systolic blood pressure.

Survey Answers in the Intra-pandemic Study

Of 379 subjects, 158 (41.7%) reported experiencing FI in the prior year. Table 2 summarizes the participants' survey answers in the intra-pandemic study; 35% of all participants reported that the COVID-19 pandemic had reduced their access to food. Participants reported that the following factors reduced their access to food during the pandemic: reduced food availability at grocery stores (31.0%); social distancing guidelines (26.5%); reduced income (19.6%); reduced access to transportation (18.3%); unemployment (17.2%); illness or additional healthcare costs (9.8%); and other factors (3.7%) (Table 2). Examples of other self-reported factors included increased food hoarding, rising food prices, and reduced reliability of food delivery services. Additionally, among subjects experiencing FI, 26.7% reported that they had to choose between buying food and buying prescription medication over the prior 12 months (Table 2).

Comparing the Pre-pandemic and Intra-pandemic Studies

The pre-pandemic study enrolled 685 total participants, 242 (35.3%) of whom were experiencing FI. The intra-pandemic study enrolled 379 total participants, 158 (41.7%) of whom were experiencing FI. This indicates a 6.4% absolute increase (18.1% relative increase) in the prevalence of FI (chi-square analysis, P=0.040, odds ratio [OR] 1.309, 95% CI 1.012-1.693).

Factors Associated with Food Insecurity in the Intra-pandemic Study

We used contingency coefficients (C) to measure the magnitude of association between specific patient characteristics and FI. During the pandemic, FI in our ED patient population was moderately associated with race (C=0.209), employment status (C=0.236), annual income level (C=0.348), and household situation (C=0.298); weakly associated with substance use history (C=0.182); and not associated with gender (C=0.036).

Logistic Regression Results

We performed a binary logistic regression to identify which patient variables may have influenced the effect of the pandemic on FI. The results of the logistic regression are detailed in Table 3. All the listed predictor variables are included in the model.

DISCUSSION

Rise in Food Insecurity

Our study found that the prevalence of FI in the ED patient population during the COVID-19 pandemic was 41.7% (Figure 2). This is more than quadruple the national prevalence of FI, as well as nearly triple the prevalence of FI in Washington, DC.[13,14] This suggests that those who use our ED during health crises are more likely experiencing FI when compared to the general population. During the COVID-19

Table 2. Survey answers describing the influence of the COVID-19 pandemic on participants' access to food.

Characteristic	Food-insecure n=158 (41.7%)	Non-food insecure n=221 (58.3%)	P-value
Has the COVID-19 pandemic changed your access to food?			
Yes. I have less access to food.	82 (52.9%)	50 (22.4%)	
No. There has been no change in my access to food.	57 (36.8%)	155 (69.5%)	
Yes. I have more access to food.	16 (10.3%)	18 (8.1%)	<0.01
Which of the following factors reduced your access to food during the COVID-19 pandemic?			
Reduced food availability at grocery stores	117 (31%)	N/A	
Social distancing guidelines	100 (26.5%)	N/A	
Reduced income	74 (19.6%)	N/A	
Reduced access to transportation	69 (18.3%)	N/A	
Unemployment	65 (17.2%)	N/A	
Illness or additional healthcare costs	37 (9.8%)	N/A	
Other	14 (3.7%)	N/A	
In the last 12 months, have you ever had to choose between buying food and buying prescription medication?*			
Yes	33 (26.7%)	8 (3.7%)	<0.01

*A total of 335 subjects (124 food-insecure subjects and 219 non-food insecure subjects) chose to respond to this survey question. In other words, 44 of the total study participants elected not to answer this question. As a result, the percentages in this row are adjusted to reflect 335 total subjects (not 379 total subjects). *COVID-19*, coronavirus disease 2019.

Table 3. Logistic regression.

Variable(s)	P-value	Odds Ratio	95% Confidence Interval
Pandemic	0.777	1.052	(0.740-1.495)
Gender	0.275	1.207	(0.861-1.693)
Race	0.001	3.029	(1.589-5.775)
Employment	0.005	1.808	(1.200-2.724)
Income	<0.0001	2.472	(1.685-3.628)
Household situation	<0.001	4.363	(2.705-7.037)
Substance use history	0.001	2.077	(1.329-3.245)

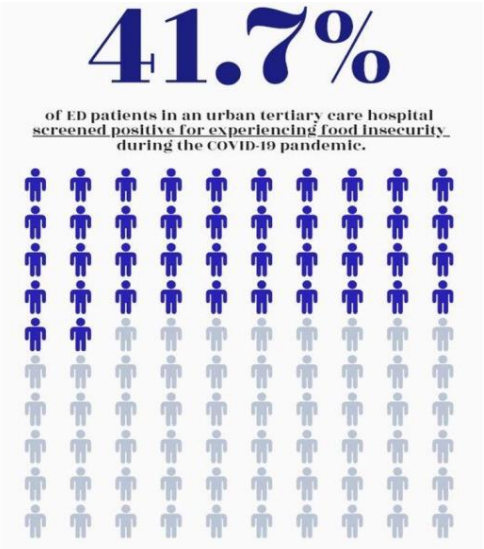

Figure 2. Prevalence of food insecurity in the emergency department patient population during the COVID-19 pandemic.

pandemic, there was an absolute 6.4% increase (or 18.1% relative increase) in the prevalence of FI in our ED patient population.[6] The majority of patients experiencing FI reported that the pandemic had reduced their access to food, whereas the majority of those not experiencing FI reported that the pandemic had not changed their access to food. This supports that the pandemic played a role in worsening FI among ED patients.

The most common perceived barriers to accessing food during the pandemic (in descending order) included reduced food availability at grocery stores, social distancing guidelines, reduced income, reduced access to transportation, and unemployment. This reveals that the socioeconomic strains imposed during a pandemic may worsen FI among patients seeking acute care. To reduce FI during future health crises, it would be worthwhile to support guidelines that limit panic-buying and promote safe transportation practices.

It is important to note, however, that the association between the pandemic and FI was only as strong as the pandemic's relationship with other patient variables. As seen in the logistic regression, there was a shared association between the pandemic and other patient traits (Table 3).

Demographics Associated with Experiencing Food Insecurity

Patients who screened positive for FI were significantly more likely to rent or live with family rather than own their own home, obtain a high school degree or General Education Diploma rather than pursue post-secondary education, be unemployed or work part-time rather than work full-time, and have a household annual income <$50,000 (Table 1). This suggests that ED patients experiencing FI have lower rates of home ownership, higher education, full-time job opportunities, and overall income. Individuals experiencing FI face competing needs for food, shelter, and education.

Changes During the Pandemic

In comparison to the pre-pandemic study, our intra-pandemic study had significantly higher proportions of participants who lived with family rather than independently. This suggests that the financial restraints of the COVID-19 pandemic may have limited an individual's ability to afford living on their own. Our intra-pandemic study also had significantly higher proportions of participants who obtained higher education (36.2% pre-pandemic vs. 63.8% intra-pandemic, $P<0.01$), worked full-time (21% pre-pandemic vs. 47.3% intra-pandemic, $P<0.01$), and had a household annual income >$50,000 (8.4% pre-pandemic vs. 41.7% intra-pandemic, $p<0.01$). This indicates that individuals of lower socioeconomic status were less likely to present to the ED during the pandemic. It is plausible that this patient population faced more challenges in traveling to the ED for medical care during the health crisis. Examples of such challenges may have included limited transportation options, inability to take time off work, or reduced income to pay for medical bills. This population may also have been more hesitant to visit the ED during the pandemic out of fear of contact with sick individuals. It is also possible that they were less likely to consent to participate.

Implications

Food insecurity has become a strong predictor for a decline in overall health including in the development of chronic conditions, many of which are preventable.[15] In addition to a decline in physical health, the development of mental health disorders (such as anxiety and depression) have also been linked to FI.[16] Moreover, nutrient deficiencies can weaken immune defense mechanisms, increasing susceptibility to infections[17] such as COVID-19, making the relationship of causality difficult to discern.

Food insecurity and COVID-19 have demonstrated a bidirectional relationship where one exacerbates the other, disproportionately affecting vulnerable populations.[18] The COVID-19 pandemic negatively impacted the economy, resulting in record unemployment and underemployment rates. As a result, FI rates increased in the general population, most notably among those who work in lower wage positions that are most vulnerable to job losses.[19] Individuals already living in poverty may live in environments, such as crowded multigenerational housing, that increase the risk for COVID-19 exposure. The effects of COVID-19 have had compounded effects upon the livelihood of vulnerable populations. It is imperative for health systems to recognize this relationship and to provide aid at the appropriate level.

On a larger level, FI is associated with exacerbations of chronic diseases and increased health expenditures.[4] As more individuals become infected with COVID-19, more patients will use the healthcare system. Food insecurity has been shown to be linked to an increased number of ED visits, hospitalizations, and extended hospital stays.[5] However, the full socioeconomic impact of COVID-19 may not immediately be evident as the effects of FI on one's overall health take time to develop.

LIMITATIONS

A number of limitations arose during the completion of this observational study. First, inclusion and exclusion criteria for participant selection challenged the generalizability of our study results. For example, non-English speaking patients, pediatric patients, prisoners, and patients in police custody were not included (Figure 1). In turn, results may not be applicable to a more diverse patient population. Similarly, patients were required to be clinically stable without alteration in mental status to participate, which may have introduced bias toward healthier patients. With data collection limited to a short time frame and occurring only during the daytime on weekdays, patients presenting overnight, on weekends, and during other times of the year were not included in the study, also potentially hindering the generalizability of results. Of note, however, the same inclusion and exclusion criteria and collection times were implemented in the pre-pandemic and intra-pandemic studies, limiting some of these sources of bias and suggesting the populations were comparable.

Additionally, our study's sample size was 44.7% smaller than in the McDonough study. This significant reduction in sample size lowered the power of our study. Notably, our small sample size likely contributed to the small effect size that described the pandemic's influence on FI. Due to fears of contracting COVID-19, many families avoided visiting the ED in 2020.[20] As a result, the overall reduction in ED volume in late 2020 probably led to fewer eligible study participants in our study, contributing to our significantly reduced sample size.

Logistics of conducting a clinical study in the time of the COVID-19 pandemic introduced further limitations to the study. As mentioned above, surveys were conducted electronically by RAs to minimize physical exchange of material. And as with any study using patient-reported responses, there is potential that results were skewed by recall bias. However, an additional risk of response bias was also introduced as patient responses were collected verbally. With stigma surrounding FI, the need to verbally report answers regarding patient experience with FI to RAs (as opposed to independent completion of paper surveys) may have led to under-reporting and falsely low prevalence of FI among our participants. Additionally, many patients chose not to participate, limiting the sample size considerably.

Many of the RAs were discouraged from or elected not to enter rooms designated for patients who tested positive for COVID-19. This further limited our sample size and led to inclusion of a healthier participant group. To limit the exposure of RAs to potential COVID-19 infection while in the ED, only one RA was present in the ED at a time. With only one RA available for data collection, some individuals presenting to the ED were admitted to the hospital or discharged before they could be approached for study participation. Additionally, unlike in past years, RAs spent additional time during the pandemic appropriately donning and doffing personal protective equipment for each patient interaction. This task likely limited the amount of time they had to visit each ED patient before they were discharged or admitted.

CONCLUSION

The prevalence of ED patients experiencing food insecurity at a high volume, urban, tertiary care center increased by 18.1% (6.4% absolute) during the pandemic. Most participants experiencing FI reported that the pandemic had reduced their access to food. Common perceived barriers to accessing food during the pandemic included reduced food availability at grocery stores, social distancing guidelines, and reduced income. It is important to make emergency physicians aware of the rising prevalence of FI so that they may better support the increased number of ED patients who must choose between purchasing food and purchasing prescribed medications. This research provides insight into the rising prevalence of FI and increasing barriers to access of food during the challenging COVID-19 pandemic. We hope our findings will provide evidence in support of increased funding for nationwide food banks and food pharmacies. Looking ahead, our findings may be used as pilot data for a larger study and help inform health policy. This work enhances our knowledge of the current health crisis' influence on health disparities, as well as on social determinants of health in the practice of emergency medicine.

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Disparate Utilization of Urine Drug Screen Nationwide in the Evaluation of Acute Chest Pain

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Introduction: Urine drug screens (UDS) have unproven clinical utility in emergency department (ED) chest pain presentations. A test with such limited clinical utility may exponentiate biases in care, but little is known about the epidemiology of UDS use for this indication. We hypothesized that UDS utilization varies nationally across race and gender.

Methods: This was a retrospective observational analysis of adult ED visits for chest pain in the 2011–2019 National Hospital Ambulatory Medical Care Survey. We calculated the utilization of UDS across race/ethnicity and gender and then characterized predictors of use via adjusted logistic regression models.

Results: We analyzed 13,567 adult chest pain visits, representative of 85.8 million visits nationally. Use of UDS occurred for 4.6% of visits (95% CI 3.9%-5.4%). White females underwent UDS at 3.3% of visits (95% CI 2.5%-4.2%), and Black females at 4.1% (95% CI 2.9%-5.2%). White males were tested at 5.8% of visits (95% CI 4.4%-7.2%), while Black males were tested at 9.3% of visits (95% CI 6.4%-12.2%). A multivariate logistic regression model including race, gender, and time period shows significantly increased odds of ordering UDS for Black patients (odds ratio [OR] 1.45 (95% CI 1.11-1.90, p = 0.007)) and male patients (OR 2.0 (95% CI 1.55-2.58, p < 0.001) as compared to White patients and female patients.

Conclusion: We identified wide disparities in the utilization of UDS for the evaluation of chest pain. If UDS were used at the rate observed for White women, Black men would undergo nearly 50,000 fewer tests annually. Future research should weigh the potential of the UDS to magnify biases in care against the unproven clinical utility of the test. [West J Emerg Med. 2023;24(2)135–140.]

INTRODUCTION

Multiple prior studies have identified racial and gender disparities in emergency department (ED) testing and care. For example, Black patients have been found to be less likely to receive pain medications for acute pain[1] and less likely to undergo comprehensive evaluations for chest pain.[2] Gender

disparities have also been noted, including in the management of coronary artery disease.[3] This is further complicated by the possible role of substance use in the development and evaluation of chest pain and coronary artery disease.

Substance use is a critical area in which to consider disparities in acute care, as there are notable societal biases across race and gender that may adversely affect quality and outcomes. These biases have been seen in the opioid epidemic, including inequity in the management of opioid use disorders.[4] These biases also are entwined with the racialized history of the "War on Drugs" since the 1980s,[5] including unjustified sentencing practices tied to terminology surrounding the use of powder cocaine and crack cocaine. At the same time, minority communities have been found to be significantly less likely to have treatment facilities available for substance use disorder.[6]

Concern for the possibility of cocaine or stimulant ingestion contributing to a patient's chief complaint of chest pain is a commonly cited reason for obtaining a urine drug screen (UDS) in the ED.[7] The UDS tests for metabolites of some common drugs of abuse, including cocaine and amphetamines; however, UDS cannot reliably identify acute intoxication and has a significant false positive rate.[8] Limited existing empirical work has addressed the usefulness of UDS in the evaluation for acute coronary syndrome, and a positive result on a UDS for cocaine or amphetamine has been found to have no predictive power for the presence of coronary artery disease in patients presenting with chest pain.[7] When a test has limited clinical utility, disparities in its use should be viewed with increased scrutiny.

Population Health Research Capsule

What do we already know about this issue?
There is minimal clinical utility of urine drug screens for patients with chest pain. However urine drug screen use may amplify biases in care.

What was the research question?
Does ordering of urine drug screens vary for patients presenting with chest pain by race and sex?

What was the major finding of the study?
Black male patients had a urine drug screen in 9.3% (95% CI 6.4%-12.2%) of visits for chest pain, compared to 4.6% (CI 3.9%-5.4%) for all patients.

How does this improve population health?
Identifying low yield testing that may amplify biases should be a component of interventions targeting health equity.

Goals of This Investigation

Our goal was to explore how often UDS is employed in the evaluation of patients presenting with chest pain in a nationally representative sample of ED visits from 2011 to 2019. We hypothesized that UDS utilization would vary significantly across race and gender.

METHODS

Design

This was a repeated cross-sectional analysis of the National Hospital Ambulatory Medical Care Survey (NHAMCS) from 2011 to 2019. The NHAMCS is a large dataset of ED visits across the US, which includes demographic data such as race and gender, chief complaint, and UDS use. The NHAMCS data is publicly available from the National Center of Health Statistics, a component of the US Centers for Disease Control and Prevention (CDC). The NHAMCS data is weighted to create a nationally representative dataset, collected via a systematic sampling of a national population of ED visits.[9]

Sample

The analysis sample was limited to adult ED visits for patients presenting with chief complaints for chest pain or ischemic heart disease. We identified visits regarding chest pain via the "reason for visit" field reported in the NHAMCS, which is coded according to a "Reason for Visit Classification for Ambulatory Care." The NHAMCS documentation includes the full classification of this coding. Reasons for visit used for inclusion in the study were "chest pain," "chest discomfort," "heart pain," "angina," and "ischemic heart disease." Reason for visit was selected over final diagnosis as we considered this to be more closely reflect the ordering practices of clinicians using information available at the time of ordering.

Outcomes and Measures

The primary outcome was whether a UDS was ordered for each visit, which is reported as a binary variable. Rates of UDS ordering were stratified across multiple characteristics, including race, gender, and time trends. Data regarding results of the UDS or specific types of drugs tested was unavailable. In the context of sample size limitations, the race variable was categorized using Black or White racial classification as well as ED visits reporting race as "unknown."

Analysis

Survey weights and complex sample design features were implemented to provide nationally representative estimates from the weighted data, and standard errors were adjusted for complex sampling design. We performed analyses in R 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria). All code to reproduce the results are available on request.

RESULTS

The analysis included 160,526 ED visits (unweighted), including 13,567 chest pain-related visits across nine years, representative of 961 million ED visits (weighted) and 85.8 million ED visits (weighted) for chest pain in that timeframe. Among all ED visits, UDS were ordered for 4.7%. Of the 85.8 million estimated ED visits for chest pain in the study period, for 3.9 million (4.6%) of them a UDS was performed. Table 1 describes the demographics of these ED visits, as well as the subset of visits for chest pain complaints.

The rate of UDS utilization in chest pain visits was 4.6% (95% CI 3.9%-5.4%). White females presenting for chest pain had a UDS rate of 3.3% (95% CI 2.5%-4.2%), while Black females had a rate of 4.1% (95% CI 2.9%-5.2%). White males were tested at 5.8% of chest pain visits (95% CI 4.4%-7.2%), and Black males at 9.3% of chest pain visits (95% CI 6.4%-12.2%). Male patients with unknown race were tested at a rate of 5.3% (95% CI 3.0-7.6%), and female patients with unknown race at a rate of 2.5% (95% CI 1.3%-3.6%) (Figure 1). Across the years of the study, UDS utilization was also noted to be increasing. In 2011, chest pain visits had a UDS

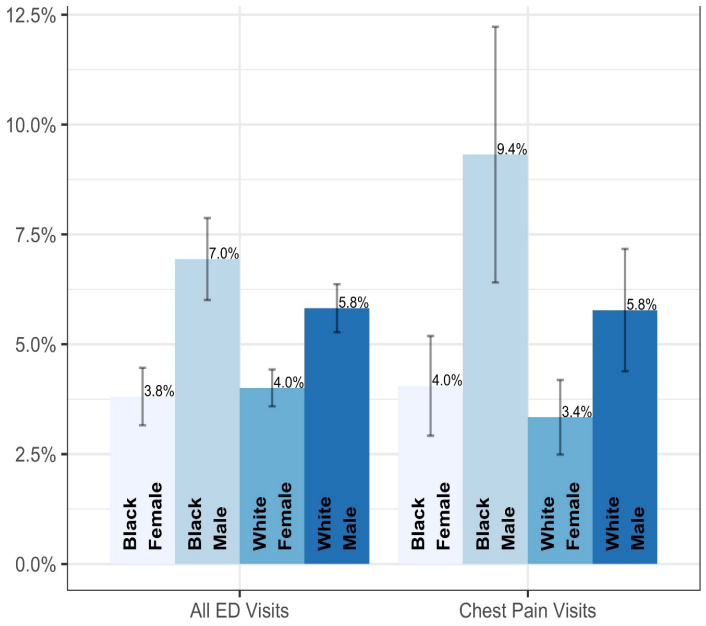

Figure 1. Urine drug screen utilization by gender and race, with 95% confidence intervals.

Table 1. Characteristics of emergency department visits for chest pain in the 2011-2019 National Hospital Ambulatory Medical Care Survey (weighted counts, rounded to the nearest thousand).

	All Visits	UDS	Visits for Chest Pain	UDS
Age				
18-29	240,938,000(25.1%)	13,013,000(28.6%)	13,325,000(15.5%)	703,000(17.7%)
30-39	169,990,000(17.7%)	9,877,000(21.7%)	13,036,000(15.2%)	933,000(23.5%)
40-49	147,636,000(15.4%)	8,263,000(18.1%)	15,379,000(17.9%)	899,000(22.7%)
50-64	201,702,000(21.0%)	9,932,000(21.8%)	23,610,000(27.5%)	1,089,000(27.5%)
65+	201,491,000(21.0%)	4,449,000(9.8%)	20,485,000(23.9%)	341,000(8.6%)
Race				
White	578,655,000(60.2%)	27,718,000(60.9%)	51,050,000(59.5%)	2,274,000(57.3%)
Black/African American	195,091,000(20.3%)	9,915,000(21.8%)	18,230,000(21.2%)	1,116,000(28.1%)
Asian	14,244,000(1.5%)	425,000(0.9%)	1,352,000(1.6%)	30,000(0.8%)
Native American/ Alaska Native	6,037,000(0.6%)	414,000(0.9%)	472,000(0.5%)	10,000(0.3%)
Native Hawaiian/other Pacific Islander	2,469,000(0.3%)	107,000(0.2%)	248,000(0.3%)	3,000(0.1%)
More than one race reported	2,497,000(0.3%)	84,000(0.2%)	211,000(0.2%)	400(0%)
Unknown	162,763,000(16.9%)	6,872,000(15.1%)	14,274,000(16.6%)	533,000(13.4%)
Gender				
Female	550,823,000(57.3%)	21,121,000(46.4%)	47,776,000(55.7%)	1,579,000(39.8%)
Male	410,933,000(42.7%)	24,412,000(53.6%)	38,060,000(44.3%)	2,387,000(60.2%)
Disposition				
Discharge	769,389,000(80%)	25,400,000(55.8%)	59,113,000(68.9%)	2,472,000(62.3%)
Admit	157,051,000(16.3%)	18,259,000(40.1%)	24,256,000(28.3%)	1,415,000(35.7%)
Transfer	33,585,000(3.5%)	1,755,000(3.9%)	2,325,000(2.7%)	72,000(1.8%)
Died	1,731,000(0.2%)	119,000(0.3%)	141,000(0.2%)	7,000(0.2%)
N (%)	961,757,000(100%)	45,533,000(100%)	85,836,000(100%)	3,966,000(100%)

UDS, urine drug screen.

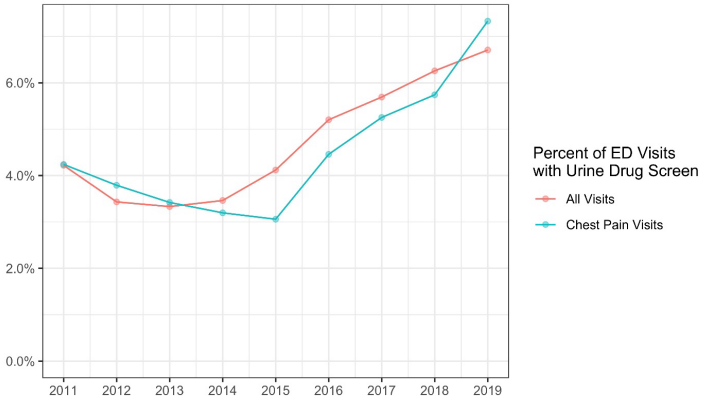

Figure 2. Urine drug screen utilization for all visits and among visits for chest pain by year.
ED, emergency department.

rate of 4.2%, increasing to 7.3% in 2019. The annual trends are shown in Figure 2.

In a multivariable logistic regression model, including time trends, male gender was associated with increased rates of UDS ordering as compared to female gender (Table 2) (2.00 odds ratio, 95% CI 1.55-2.58). Similarly, Black race was associated with increased odds of UDS ordering as compared to White race (1.45 OR, 95% CI 1.11-1.90).

DISCUSSION

Despite the lack of clear clinical utility for UDS in the ED evaluation of patients with chest pain, the frequency of UDS testing has grown considerably nationwide and is disproportionately used in the evaluation of Black men with chest pain. Based on the national estimates, if the rate of UDS ordering for Black men were the same as that for White women, Black men presenting to EDs with chest pain would have nearly 50,000 fewer UDS performed per year.

The UDS has poor clinical utility in the ED. In the hospital setting, the drugs tested for vary, but many hospitals perform an immunoassay for metabolites of amphetamines, cocaine, cannabis, opiates, barbiturates, and benzodiazepines. In identifying these metabolites, the urine testing can remain positive for days to weeks after the last use. Additionally, many of the screened drugs have a variety of false positives and false negatives, including common prescribed and over-the-counter medications. In the ED, these characteristics severely limit the ability of the UDS to recognize acute intoxication or identify clinically relevant substance use. Prior work in the toxicology community has argued that due to these issues, the UDS should rarely, if ever, be used to guide management for acute presentations.[8]

Some may argue that there are specific scenarios regarding chest pain presentations where the knowledge of acute cocaine or stimulant intoxication has notable clinical relevance. While the UDS provides information regarding recent exposure, the limitations in acute settings will significantly blunt its ability to guide chest pain workups. Chronic cocaine use has been associated with atherosclerosis; however, existing data has shown no difference regarding the prevalence of coronary artery disease based on a positive UDS in those presenting with chest pain.[7] Additionally, our results note that the UDS rate for all complaints is similar to those presenting with chest pain (4.7% vs 4.6%, respectively). This further casts doubt on the consideration that UDS be ordered specifically in targeted chest pain evaluations.

Multiple studies have attempted to quantify the prevalence of substance use across populations with conflicting answers. Overall drug use rates are similar across Black and White populations,[10] with methamphetamine use reported higher in White populations and similar rates of cocaine use in all groups. A recent study shows lower overdose death rates involving methamphetamines in Black populations,[10] but rates of deaths involving cocaine are higher in Black populations.[12] Similar rates by gender of positive cocaine or methamphetamine testing have been seen in patients admitted for chest pain observation.[10] Notably higher rates of methamphetamine use are seen in Native American/Alaskan Native populations;[10] unfortunately due to the sample size limitations in the NHAMCS, this study could not comment on any ordering disparities regarding that population.

Arbitrary or bias-driven variations within clinical practice are a concern within emergency medicine. Some variation within clinical practice is inevitable, as identical workup and management is not indicated for every presentation for the same chief complaint. However, with increasing awareness

Table 2. Associations of urine drug screen use in all ED patients using multivariable logistic regression.

	OR	95% CI	P-value
Gender			
Male	1.998	1.550-2.577	<0.001
Female	(ref)		
Race			
Black/African American	1.453	1.110-1.901	0.007
White	(ref)		
Year (linear trend)	1.104	1.036-1.177	0.002

OR, odds ratio; *CI,* confidence interval.

of the role of implicit, explicit, and institutional biases, our results underscore the need to consider the utility of the UDS. Further, as drug use continues to be highly stigmatized, consideration must be given to the biased and disparate care that the results of the UDS may create. Given the complicated interplay between healthcare inequities, racism (both structural and interpersonal), and the stigma regarding substance use, it is incumbent upon emergency physicians to recognize how these factors weigh on clinical decision-making. This importance is only magnified when we consider that the clinical utility of the test in question is poorly justified, as in the case of the UDS for chest pain presentations.

LIMITATIONS

This study has several limitations, primarily related to reliance on a secondary analysis of previously collected data. We did not have a patient-oriented or clinical outcome; future investigations should explore how ordering practices might have downstream consequences for patients. Despite this lack of clinical outcome, there is an absence of empirical data justifying the broad use of UDS in the evaluation of chest pain; and at the same time disparities persist in care access, quality, and outcomes for Black patients. Furthermore, due to sample size limitations, we were unable to address all patient-reported race/ethnicity categories; thus, our study is limited to analyzing only Black and White patients, rather than reflecting the entire emergency care patient population nationally. This inherently does not reflect the complexities of race and ethnicity self-identification, nor can it account for inaccuracies in the collection of this datapoint. However, given the racialized history of drug policy in the US that uniquely targets Black communities, we feel that our results are important despite this limitation.

The NHAMCS data does have some limitations,as with any retrospective data collection, but significant effort is taken by the CDC to maximize its utility as a representative sample.[9] Additionally, the NHAMCS does not provide the information to analyze hospital-level variation of the disparities identified in this study, which will need to be analyzed with alternative sources of data. Specifically, our study highlights the need to understand whether the increased use of UDS among Black patients reflects clinician, hospital, or even regional variation.

CONCLUSION

In this study we identify notable disparities in UDS use for ED patients presenting for chest pain, with Black male patients having significantly higher odds of receiving a urine drug screening. Given existing work that UDS is not useful for ruling out clinically significant coronary artery disease, alongside the notable limitations of clinical information provided by the test, the emergency medicine community should apply scrutiny to its ongoing use. Going forward, future investigations should consider the mechanisms behind this ordering disparity, as well as possible downstream clinical and non-clinical impacts.

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Assessing the Relationship Between Race, Language, and Surgical Admissions in the Emergency Department

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Introduction: English proficiency and race are both independently known to affect surgical access and quality, but relatively little is known about the impact of race and limited English proficiency (LEP) on admission for emergency surgery from the emergency department (ED). Our objective was to examine the influence of race and English proficiency on admission for emergency surgery from the ED.

Methods: We conducted a retrospective observational cohort study from January 1–December 31, 2019 at a large, quaternary-care urban, academic medical center with a 66-bed ED Level I trauma and burn center. We included ED patients of all self-reported races reporting a preferred language other than English and requiring an interpreter or declaring English as their preferred language (control group). A multivariable logistic regression was fit to assess the association of LEP status, race, age, gender, method of arrival to the ED, insurance status, and the interaction between LEP status and race with admission for surgery from the ED.

Results: A total of 85,899 patients (48.1% female) were included in this analysis, of whom 3,179 (3.7%) were admitted for emergent surgery. Regardless of LEP status, patients identifying as Black (odds ratio [OR] 0.456, 95% CI 0.388-0.533; P<0.005), Asian [OR 0.759, 95% CI 0.612-0.929]; P=0.009), or female [OR 0.926, 95% CI 0.862-0.996]; P=0.04) had significantly lower odds for admission for surgery from the ED compared to White patients. Compared to individuals on Medicare, those with private insurance [OR 1.25, 95% CI 1.13-1.39; P <0.005) were significantly more likely to be admitted for emergent surgery, whereas those without insurance [OR 0.581, 95% CI 0.323-0.958; P=0.05) were significantly less likely to be admitted for emergent surgery. There was no significant difference in odds of admission for surgery between LEP vs non-LEP patients.

Conclusion: Individuals without health insurance and those identifying as female, Black, or Asian had significantly lower odds of admission for surgery from the ED compared to those with health insurance, males, and those self-identifying as White, respectively. Future studies should assess the reasons underpinning this finding to elucidate impact on patient outcomes. [West J Emerg Med. 2023;24(2)141–148.]

INTRODUCTION

Background

Racial inequities harm the health of racially and ethnically marginalized individuals.[1] Racism has been shown to adversely affect nearly all facets of the healthcare system, from insurance status[2] to clinician ratings of pain levels[3] to readmission after surgery.[4] Even when controlling for variables known to influence health outcomes such as insurance status, education, and income, the effects of racism on health remain significant and play independent and likely causal roles in health disparities.[5]

Approximately 67.3 million people in the United States speak a language other than English at home,[6] and recent estimates suggest that 1 in 10 working-age Americans have limited English proficiency (LEP), a term used to describe not being fluent in the English language. Limited English proficiency individuals are known to have poorer quality and less access to healthcare when compared to those with English proficiency.[7] Previous studies have shown that patients with LEP experience increased postoperative hospital admissions, significantly increased risk of infection,[8] and more unplanned ED revisits.[9] Further, patients with LEP have also been shown to have increased in-hospital mortality rates, as well as an increased frequency of major adverse cardiovascular and cerebrovascular events.[10] The combined effects of race and English language proficiency have been relatively understudied, in part due to many studies combining language and race variables, thereby preventing any independent measurement. Current literature suggests that LEP and race are related and, although they serve as potential confounders, impact different aspects of a patient's health journey.

While sociocultural factors such as race, English proficiency, and ethnicity are understood to impact ED and inpatient quality of care, the need to undergo emergency surgery is not often clearly or directly influenced by such factors. Thus, examining urgent surgery procedures provides a unique opportunity to evaluate the impact of racism and language proficiency on surgical care delivery.

Population Health Research Capsule

What do we already know about this issue?
Racism adversely affects many facets of the healthcare system, including patient insurance status, clinician ratings of pain levels, and readmission after surgery.

What was the research question?
What is the impact of race and limited English proficiency on admission for emergency surgery from the emergency department?

What was the major finding of the study?
Compared to White patients, those identifying as Black (OR 0.456, 95% CI 0.388-0.533; P<0.005) or Asian (OR 0.759, 95% CI 0.612-0.929; P=0.009) had significantly lower odds for admission for surgery. Females similarly had lower odds for admission than males (OR 0.926, 95% CI 0.862-0.996]; P=0.04), but we found no difference in English language proficiency.

How does this improve population health?
Our data contributes to research evaluating the impact of widespread surgical disparities experienced by Black, Asian, and female patients.

Objectives

Our goal was to assess the impact of racism – with race and LEP status as proxy measures thereof – on rates of admission for emergent surgery from the ED.

METHODS

Study Design and Setting

We conducted this single-hospital, retrospective observational study at a 1,011-bed quaternary care, urban, academic medical center treating approximately 110,000 ED patients annually. With 66 beds, the ED serves as a Level I trauma center, a Level I burn center, and a comprehensive stroke and ST-elevation myocardial infarction center.[11–13] The study was compliant with the Health Insurance Portability and Accountability Act and was approved with exemption by the study site's institutional review board.

Participants

To exclude major volume changes in the ED due to the coronavirus 2019 pandemic, we analyzed all patients (adult and pediatric) presenting to the ED between January 1–December 31, 2019 who were also admitted for surgery from the ED. Importantly, we only included patients who had surgery and did not include patients who were admitted for a surgical indication (eg, small bowel obstruction) but did not ultimately undergo surgery. Surgery was defined via indication in the electronic health record (EHR) and included minor (eg, drain placement) surgical procedures, although these were a minority (<5%) of the surgical cases. Participants were identified using the EHR (Epic Systems, Verona, WA).[14] We extracted records for all ED admissions and all surgeries performed during the study period.[15,16] This data was then cross-referenced to identify individuals who presented to the ED and underwent surgery on the day of or day after admission to the ED. Undergoing surgery the day of or the day after admission was defined as "emergent" surgery in this study.

Participants were excluded if they were missing data on the use of an interpreter, preferred primary language, method of arrival to the ED (eg, public transportation, car, ambulance), or if they were dead on arrival at the ED. We did not exclude any patients based on criteria of frequent ED use, as we sought to maximize our detection of patients who were admitted for surgery. We placed no restrictions on the type of surgery for which patients were admitted. Patients were considered to be LEP if they used hospital interpreter services. Of note, patients were excluded if their method of arrival to the ED was unavailable because we believed it would be a significant confounder of their likelihood of being admitted for emergent surgery if not controlled for (ie, arriving via medical flight is associated with more severe illness than via public transportation and thus increases the chances the patient will be

admitted for surgery). We analyzed only individuals with LEP who used hospital interpreter services.

Outcome Measures and Data Collection

The primary outcome for this study was direct admission for surgery from the ED. For each patient, we obtained the following data: age; gender; race; ethnicity; whether they were admitted for surgery; whether they used a hospital interpreter; insurance status; and their method of arrival to the ED. Patients who self-reported they were of Hispanic ethnicity were automatically considered to be of Hispanic race; however, all other self-reported races were taken from the race category in the EHR instead of the ethnicity column. This was required due to an error in the EHR data retrieval system that did not report race for individuals who selected Hispanic in the chart.

Statistical Methods

We compared the distribution of demographic variables by those patients admitted for surgery from the ED and those patients not admitted for surgery using the Wilcoxon test (for continuous variables) and Pearson's chi-square test (for categorical variables). A multivariable logistic regression model was fit to examine the odds of admission for surgery as a function of interpreter use (interpreter vs no interpreter), age, gender (female vs male), race (Black, Asian, Hispanic/Latino, American Indian/Alaskan, Native/Native Hawaiian, other vs White), method of arrival to the ED (ambulance, public transportation/car, police, hospital transport, medical flight, other), insurance (Medicare, Medicaid, private insurance, uninsured), with an interaction between race and use of an interpreter. Adjusted odds ratios (aOR) and 95% confidence intervals (CI) are presented for all model covariates. A more parsimonious multivariable model was run with race and LEP status as regressors prior to adjusting for age, gender, insurance, status, and method of admission to the ED.

We assessed multicollinearity between race and being LEP by estimating variance inflation factors (VIF) to assess whether both variables should be included in the model, as it was thought that certain races recorded may be more likely to use an interpreter. A type I error of 5% was used for all CIs and hypothesis tests. We performed all statistical analysis in RStudio version 1.2.1335 (Boston, MA) and Prism version 9.3.0 (GraphPad Software, San Diego, CA).

RESULTS

Study Cohort

A total of 114,447 patients presented to the ED during the study period, of whom 85,899 were eligible for inclusion in the study (Figure, Table 1). A total 9,874 (11.5%) were LEP, and 76,025 (88.5%) were English proficient (EP). Of the eligible patients, 3,179 (3.70%) were admitted for surgery, of whom 373 (11.7%) were LEP. Mean age was significantly higher in the group admitted for surgery compared to the unadmitted group (48.8 vs 47.1, respectively; $P<0.001$; median age overall 44 interquartile ratio=36), although this distinction is unlikely to bear clinical significance. There were 41,299 (48.1%) self-reported females in the total sample, and 1,459 (45.9%) of those admitted for surgery were female ($P=0.01$) (Table 1).

Of the study population 9,949 (ll.6%) self-reported they were Black, and 54,307 (63.2%) reported they were White. Of the individuals admitted for surgery, 73.5%

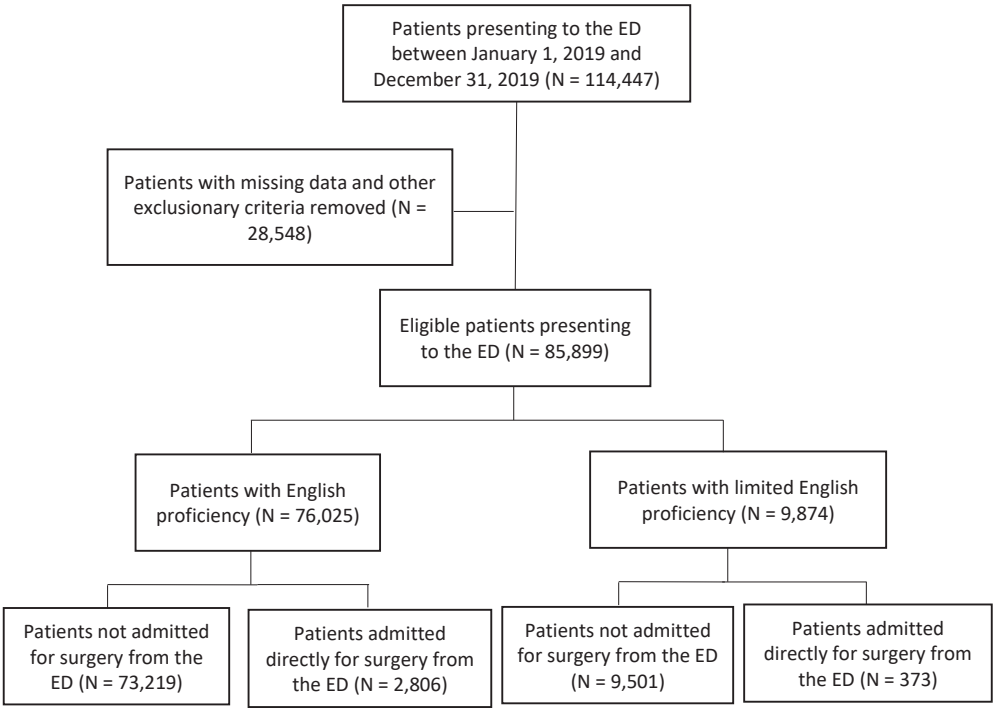

Figure. Study cohort flow chart for patients admitted from the emergency department (ED) to surgery.

Table 1. Descriptive statistics stratified by admission for surgery from the ED.

	Admitted for surgery (N = 3,179)	Non-surgical patients (N = 82,720)	Combined (N = 85,899)	Percentage of patients in each sub-category admitted for surgery (%)	*P*-value
Age (SD)	49.36 (23.67)	45.16 (23.06)	45.31 (23.09)		<0.001
Gender					0.01
Male	1,720 (54.1)	42,880 (51.8)	44,600 (51.9)	3.86	
Female	1,459 (45.9)	39,840 (48.2)	41,299 (48.1)	3.53	
Race					<0.001
White	2,338 (73.5)	51,969 (62.8)	54,307 (63.2)	4.31	
Black	188 (5.9)	9,761 (11.8)	9,949 (11.6)	1.89	
Asian	139 (4.4)	4,225 (5.1)	4,364 (5.1)	3.19	
Hispanic	154 (4.8)	4,014 (4.9)	4,168 (4.9)	3.69	
American Indian/Alaska Native/ Native Hawaiian	7 (0.2)	384 (0.5)	391 (0.5)	1.79	
Other	353 (11.1)	12,367 (15.0)	12,720 (14.8)	2.78	
Method of ED arrival					<0.001
Ambulance	1,526 (48.0)	24,550 (29.7)	26,076 (30.4)	5.85	
Public transport/car	1,304 (41.0)	48,238 (58.3)	49,542 (57.7)	2.63	
Police	0 (0.0)	130 (0.2)	130 (0.2)	0.0	
Medical flight	141 (4.4)	271 (0.3)	412 (0.5)	34.2	
Hospital transport	27 (0.8)	358 (0.4)	385 (0.4)	7.01	
Other	181 (5.7)	9,173 (11.1)	9,354 (10.9)	1.94	
Insurance status					<0.001
Medicare	1,014 (31.9)	22,532 (27.2)	23,546 (27.4)	4.31	
Medicaid	468 (14.7)	16,966 (20.5)	17,434 (20.3)	2.68	
Private insurance	1,683 (52.9)	42,397 (51.3)	44,080 (51.3)	3.82	
Uninsured	14 (0.4)	825 (1.0)	839 (1.0)	1.67	
Interpreter use					0.69
Yes	373 (11.7)	9,501 (11.5)	9,874 (11.5)	3.78	
No	2,806 (88.3)	73,219 (88.5)	76,025 (88.5)	3.69	

Note: Differences in the total number of individuals in a category are due to different numbers of patients who were excluded from the final sample after study criteria were applied to the total sample. P-values represent comparisons of the distributions for each category, not pairwise comparisons of each subcategory. Values represent the total number of individuals (percentage). Number of participants that were excluded due to missing data for each variable: age (0); gender (0); race (4,087); method of ED arrival (51); insurance status (0); interpreter use (0). *ED*, emergency department; *SD*, standard deviation.

(2,338) were White, 5.92% (188) were Black, 4.38% (139) were Asian, and 4.85% (154) were Hispanic. Importantly, 4.31% (2,338/54,307) of individuals identifying as White were admitted for surgery, 1.89% (188/9,949) of individuals identifying as Black were admitted for surgery, 3.69% (154/4,168) of Hispanic individuals were admitted for surgery, and 3.19% (139/4,364) of individuals identifying as Asian were admitted for surgery. Of all individuals admitted for surgery, 1,304 (41.0%) arrived via public transit or car and 1,526 (48.0) arrived by Ambulance.

Key Results

The simpler multivariable logistic regression model found that LEP individuals had significantly higher odds of admission for surgery compared to EP individuals (OR 1.33, CI 1.17-1.50; $P<0.005$) (Table 2). However, after adjusting for age, gender, method of arrival to the ED, race, and insurance status, the analysis failed to detect a significant difference in the number of individuals with LEP who were admitted for surgery from the ED compared to those with English proficiency (3.78% vs 3.69%; $P=0.69$). The odds of admission for surgery were significantly lower for patients who self-reported Black or Asian race (aOR, 0.456, CI 0.388-0.533, $P<0.005$, and aOR 0.759, CI 0.612-0.929; $P=0.009$, respectively). Females were significantly less likely to be admitted for surgery compared to males (aOR 0.926, CI 0.862, 0.996, $P=0.04$). Patients were more likely to be admitted

Table 2. Overall multivariable logistic regression results.

	Simple model		Fully adjusted model	
Variable	OR (95% CI)	P-value	aOR (95% CI)	*P*-value
Intercept	0.0446 (0.0427, 0.0464)	< 0.005	0.0629 (00516, 0.0766)	< 0.005
Limited English proficiency				
(Interpreter required)	1.33 (1.17, 1.50)	< 0.005	0.994 (0.769, 1.264)	0.96
Age	--	--	1.00 (1.00,1.00)	0.02
Gender (Female)	--	--	0.926 (0.862, 0.996)	0.04
Arrival method	--	--		
Ambulance			Reference	Reference
Public transportation/car			0.443 (0.409, 0.479)	< 0.005
Police			0.00000839 (0.00, 0.000119)	0.88
Hospital transport			1.23 (0.807, 1.79)	0.31
Medical flight			7.88 (6.37, 9.72)	< 0.005
Other			0.321 (0.273, 0.374)	< 0.005
Race				
White	Reference	Reference	Reference	Reference
Black	0.422 (0.362, 0.489)	< 0.005	0.456 (0.388, 0.533)	< 0.005
Asian	0.689 (0.575, 0.818)	< 0.005	0.759 (0.612, 0.929)	0.009
Hispanic/Latino	0.787 (0.661, 0.930)	0.00591	0.828 (0.664, 1.02)	0.09
American Indian/Alaska Native/Native Hawaiian	0.404 (0.173, 0.789)	0.0177	0.499 (0.213, 0.979)	0.07
Other	0.564 (0.496, 0.639)	< 0.005	0.610 (0.517, 0.715)	< 0.005
Insurance status	--	--		
Medicare			Reference	Reference
Medicaid			0.877 (0.766, 1.002)	0.06
Private insurance			1.25 (1.13, 1.39)	< 0.005
Uninsured			0.581 (0.323, 0.958)	0.05
LEP: Race interaction	--	--		
LEP:White			Reference	Reference
LEP:Black			1.29 (0.726, 2.20)	0.36
LEP:Asian			1.36 (0.862, 2.12)	0.18
LEP:Hispanic/Latino			1.63 (1.08, 2.47)	0.02
LEP:American Indian/Alaska Native/Native Hawaiian			1.90 (NA, NA)	0.96
LEP:Other			1.51 (1.10, 2.11)	0.01

CI, confidence interval; *OR*, odds ratio; *aOR*, adjusted odds ratio; *LEP*, limited English proficiency.

for surgery if they had private insurance (aOR 1.25, CI 1.13-1.39; *P*<0.005) and less likely if they were uninsured (aOR 0.581, CI 0.323-0.958; *P*=0.05).

Patients were also less likely to be admitted for surgery if they arrived by public transportation or car (aOR 0.443, CI 0.409-0.479]; *P*<0.001) when compared to arrival by ambulance. Conversely, subjects were more likely to be admitted if they arrived via medical flight (aOR 7.88, CI 6.37-9.72; *P*<0.005). Interestingly, despite self-reported Hispanic race not being significant independently, a significant interaction was reported among LEP individuals who were Hispanic (aOR 1.63, CI 1.08-2.47; *P*=0.02), suggesting that Hispanic individuals who were also LEP were more likely to be admitted for surgery than their non-LEP counterparts. Variance inflation factors assessed in the dual-variable model revealed no significant multicollinearity (VIF_{LEP}=1.06; VIF_{race}=1.02).

DISCUSSION

In this study of the association between race, LEP, and admission for surgery from the ED, multivariable

logistic regression analysis determined that individuals self-identifying as Black or Asian had significantly lower odds of admission compared to individuals self-identifying as white. There was no evidence of a significant difference in the odds of admission for surgery among LEP compared to EP patients. We also found significantly lower odds of direct admission from the ED for surgery on individuals self-identifying as female and those without insurance, whereas individuals with private insurance had significantly higher odds of admission for surgery.

The fact that racial minorities experience lower rates of healthcare utilization[17] and poorer postoperative outcomes[18] is well characterized. However, to our knowledge, this is the first study finding that minorities are less likely to be admitted for emergent surgery from the ED, a time when indications for care are thought to be less dependent on subjective measures and judgments known to introduce bias (eg, pain ratings).[19] Future studies should be performed to better understand what factors are driving lower admission rates for surgery among minorities and women, looking specifically at measures of discrimination among patients in the ED.

There are several reasons why racial and lingual minorities may have lower odds of admission for surgery. Disparities in rates of surgery between minorities and Whites have been previously reported in accountable care organizations.[17] Such disparities may stem from systemic racism within health systems, differential levels of access to ED care, varying clinician assessments of minorities' pain levels,[20] or varying levels of health literacy among LEP communities.[21] Another possible explanation is that racial minorities are less likely to have access to a primary care physician, which then leads them to use the ED as a first point of care. This has been shown in multiple studies and is known to influence admission rates to the hospital from the ED and ED presentation.[22–24] Another explanation is that clinician biases lead to differences in the assessment and triage of patients who are at risk of needing emergent surgery, which could lead to either a decrease in the percentage of Black and Asian patients admitted for surgery from the ED overall or a delay in admission for surgery, which would not have been detected in this study because we limited admission for emergent surgery to one day after admission.

We found no evidence of a significant difference in admission for surgery in LEP individuals compared to EP individuals. In the context of non-emergent surgery, other researchers have found that LEP individuals are significantly less likely to pursue surgical treatment options.[25] However, Ngai et al, who examined rates of inpatient admission from the ED in LEP and EP individuals, found no significant difference in admission rates between the two groups but did detect a significant increase in unplanned readmissions among the LEP group compared to the EP group.[9] However, a recent systematic review suggests that any increase in readmissions among LEP individuals may be concentrated to the setting of chronic disease (eg, heart failure) but not for surgeries or acute procedures.[26] Taken together, the paucity of existing data as well as the findings of this study suggest no difference in admission from the ED but disparities elsewhere in the care process. One hypothesis to explain this may be that indications for admission for surgery are not always dependent on communication between the patient and clinician; however, this was not measured in this study or the cited studies herein.

All females in this study were less likely to be admitted for surgery from the ED, despite making up 48.1% of the sample. This could be a result of documented discriminatory practices among women (in particular minority women).[27] The results obtained for the odds of admission for surgery based on the patient's method of arrival to the ED were expected, as it is more likely that an individual arriving via hospital transport or medical flight is in a more severe condition and in need of surgery than one arriving via public transportation or car.

Uninsured individuals were significantly less likely to be admitted for emergent surgery, while those with private insurance were significantly more likely to be admitted for emergent surgery in this study. Despite common perceptions to the contrary, research suggests that uninsured individuals use the ED at comparable rates to their insured counterparts[28] but do receive other forms of care less frequently than those with insurance,[29] suggesting that overall utilization rates alone are unlikely to explain the admission rates for surgery found. Although substantial data exists suggesting that the uninsured experience worse outcomes after surgery,[30] little data exists that sheds light on why uninsured individuals may have lower odds of admission for emergent procedures. It is possible that this is a decision rooted in implicit considerations of lower reimbursements and worse expected outcomes, but it is also possible that patients without insurance choose not to go to the ED in the first place because of the costs associated with receiving care without insurance.

The fact that Hispanic individuals who were also LEP were more likely to be admitted for surgery than their non-LEP counterparts deserves further exploration. Similarly, the fact that those identifying as Black or Asian had significantly lower odds of admission for emergent surgery while those identifying as Hispanic did not should also be re-examined in future studies. We believe the most likely explanation for this variation is found in the small sample sizes of our racial minority groups compared to the group identifying as White. However, this result should be replicated in future studies to assess its generalizability across institutions.

LIMITATIONS

This study has several limitations. First, the data is from a single institution and is retrospective in design, limiting its generalizability to other institutions and preventing it from making any causal conclusions. Second, this data did not account for individuals who may have been LEP themselves but arrived with a family member or friend who could

translate for them, which would preclude these individuals from being identified as LEP in this study. This also includes scenarios in which residents or attending physicians may have spoken the patient's language fluently and opted not to use an interpreter. Further, approximately 10% of the initial pre-filtered study sample was excluded because those patients did not report whether or not they required an interpreter, and 3.9% of individuals in the initial pre-filtered study sample had unavailable or missing race data. We do not believe these omissions had significant effects on the results of this study, as the percentage of missing race data is minimal. Further, it likely that most individuals who did not report requiring an interpreter did not require interpreter services (as it is mandated by law to provide an interpreter, which would be reported in the chart). These factors would likely influence the number of patients counted as LEP and could thus skew the results obtained. However, all individuals who reported that English was not their primary language used an interpreter; thus, we believe the potential effects of excluding this group are minor.

We did not assess why minorities, women, and the uninsured were less likely to be admitted for emergent surgery from the ED, which now represents a major area of research for future studies. Further, our analysis includes primarily socioeconomic variables, and it is important to consider for future studies that there may be myriad other clinical factors that influence admission that were not reported here. Another limitation of this study is that the patients were not stratified based on their admitting chief complaint or time of admission throughout the week. It is possible that there may be a difference in emergent surgery admission rates in institutions that practice surgical smoothing (eg, delaying some cases, such as cholelithiasis, to be performed on Monday instead of immediately over the weekend) vs those that do not. Future studies should take the opportunity to compare the most prevalent chief complaints in the ED to see whether the results herein hold for patients presenting with similar problems.

This study demonstrates that disparities in rates of admission for emergent surgery from the ED exist and may be a contributive variable in existing health disparities within ED care. The differences documented may reflect larger differences in rates of presentation to the ED among racial and ethnic minorities, and it serves as one potential explanation for why many racial and ethnic minorities are hesitant to receive care in the ED. Regardless, this study highlights the need for both further study and institutional reflection on practices of evaluation and admission for emergent procedures from the ED.

CONCLUSION

We found that individuals identifying as being female, Black, Asian, or uninsured have significantly lower odds of direct admission for surgery from the ED. We did not find evidence that individuals with limited English proficiency status were more or less likely to be admitted for emergent surgery compared to their EP counterparts. Further studies are needed to clarify what other factors influence a patient's admission for surgery outside of race, gender, and insurance status. Further studies are also needed to elicit the causal factors for admission for surgery from the ED.

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Why Emergency Physicians Should Advocate for Suspension of Title 42 Restrictions on Asylum for US Immigrants

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In an interview with *Time* magazine in 2019, Violeta Monterroso described her fears and inability to return to Guatemala after a gang attempted to extort her and threatened the lives of her family. "They kill the people and kill their children. The first thing is to have security for them," Monterroso said of her kids, "that nothing bad happens to them."[1]

Undocumented immigrants frequently present to emergency departments (ED) in the United States. Conversely, they may not present until late in their disease course for fear of discovery and deportation. Either way, the status of undocumented immigrants is squarely "in the lane" of emergency medicine and deserves advocacy on par with other issues that plague our underserved patient population. Title 42 expulsion is a provision of the Public Health Service Act of 1944. In short, it is a policy that enables the federal government to restrict an individual's entry to the US due to public health concerns.[2] It was first implemented in March 2020 by the Trump administration as part of the broad range of actions to address the coronavirus disease 2019 (COVID-19) pandemic.

Such experiences like those Ms. Monterroso described are not isolated events, with one study quantifying 23% of asylum seekers fleeing gang violence and 34% fleeing violent family members.[3] The countries from which many of these individuals emigrate often have civilian violent death rates comparable to countries at war.[4] As physicians, we have an obligation to recognize the health and human realities that our patients face, as well as the consequences that immigration policies have on these already marginalized people.

As emergency physicians, we must also consider what effects immigration has on our EDs. Current narratives perpetuate the myth of migrants as disproportionately using emergency services. Objective measures do not support this. Recent studies demonstrate that refugees used emergency services less frequently than non-refugee controls.[5] Undocumented immigrants are noted to use emergency services less frequently than US citizens and other migrant groups.[6] Interventions connecting undocumented immigrants to primary care services have been demonstrated to reduce ED visits.[7] Migrants face unique challenges when presenting for emergency care. For example, they may be hesitant to report labor abuses, sexual violence, or physical assault, or be unable to pay for outpatient primary care or specialty services.[8] Despite these challenges, one study estimates that healthcare expenditures for immigrants, undocumented or authorized, cost less per capita compared to US-born patients.[9] We should not accept policies that curtail legal immigration and instead push toward unauthorized migration and more complicated emergency care.

The primary argument for implementing Title 42 was to protect the US public from COVID-19 exposures resulting from potential cases crossing the border. One of the populations most affected by Title 42 were asylum-seekers who came to the US southern border via Mexico to seek entry on grounds of safety or fear of persecution in their native country. Prior to implementation of Title 42, the policy of Migrant Protection Protocol (MPP), commonly referred to as "Remain in Mexico," instituted new procedures to hold them in Mexico during their legal asylum proceedings. With the start of the COVID-19 pandemic, Title 42 was used to effectively end nearly all migration and asylum claims processing at the US-Mexico border. The US Border Patrol estimates there was a dramatic increase to 1,040,220 Title 42 expulsions in 2021, compared to 197,043 expulsions in 2020.[10] Most migrants were unable to file an asylum claim. For those who have filed claims through MPP, a backlog in processing could lead to wait times of almost four years.[11]

Title 42 was continued under the Biden Administration. An attempt to lift it was blocked in May 2022 by a federal judge in Louisiana after a lawsuit was filed by the attorneys

general of Arizona and 24 other states. His decision cited a failure to follow procedure to obtain public comment and evaluate strains to local healthcare, education, and law enforcement.[12] A decision is pending from the US Court of Appeals for the Fifth Circuit. In November 2022, a federal judge on the US District Court for the District of Columbia ordered the lifting of Title 42, citing that it violated the administrative procedures act and that the US Centers for Disease Control and Prevention had failed to consider alternatives.[13] A stay was issued shortly thereafter, giving the Biden Administration until December 21 to prepare for the transition. A definitive end for Title 42 remains elusive.

Title 42 is problematic for several reasons. Despite its implementation as a public health order, multiple leading health and human rights organizations have said there is no public health or rigorous data that supports the claim that these restrictions have mitigated the COVID-19 pandemic in the US.[14] In fact, former White House medical advisor Dr. Anthony Fauci asserted that immigration is not a principal driver of COVID-19 transmission and that expelling immigrants is not the solution to outbreaks.[15]

Since the onset of the pandemic, the US never completely closed its borders to foreign travel. International travel has been allowed since November 2021. Special immigration exceptions have been made for Ukrainian and Afghani citizens, while barring Haitian, Venezuelan, and other Central and South American asylum seekers. COVID-19 has been widespread in the US since 2020. Title 42 is increasingly being supported from an immigration policy perspective, rather than from a public health perspective. We should be wary of the dangers of such political actions, especially since clear racial and ethnic biases have developed.

Furthermore, Title 42 and other strict border policies put asylum seekers at health risk in two key ways. First, broad restrictions on legal immigration hold vulnerable people in crowded, under-resourced, and dangerous situations indefinitely. In complying with Title 42, asylum seekers are kept in Mexico or other countries without fulfillment of previously mandated medical screening.[16] There is little protection from violence,[17] and many develop severe mental health disorders from the both the emotional and physical trauma suffered.[18] Migrants cite barriers to healthcare in Mexico including costs,[19] food insecurity,[20] and crowded shelters with infectious disease outbreaks.[21]

Secondly, when faced with these dangers of waiting indefinitely under Title 42, asylum seekers may instead choose to cross increasingly dangerous walls and subsequently encounter militarized border guards or perilous natural obstacles including the Sonoran Desert and the Rio Grande River. An example is the San Diego-Tijuana border wall, which after being raised from 17 feet to 30 feet was associated with a five-fold increase in the number of hospital admission for border wall falls at the trauma center of the University of California, San Diego (67 fall admissions prior to compared to 375 after the height change).[22] Other threats include the risk of death from environmental exposures such as dehydration or drowning, with 609 migrant bodies found as of July 19, 2022, compared to 566 in all of 2021.[23] The worst human smuggling-related incident in modern US history occurred when 51immigrants were found dead in a truck trailer in San Antonio, TX, on June 27, 2022.[2]

Emergency physicians are uniquely sensitive to the effects of public health policy. By allowing the weaponization of public health toward immigration policy, we are conceding a major component of our profession to the realm of politics. Regardless of political affiliations, the concession of public health policies runs contrary to our role to advocate for our patients, within *and* outside the ED. Emergency physicians should advocate for the suspension of Title 42 as a harmful and unnecessary policy that directly and indirectly affects emergency patients, healthcare, and society.

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Revisiting "Excited Delirium": Does the Diagnosis Reflect and Promote Racial Bias?

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Introduction: "Excited delirium" (ExD) is purported to represent a certain type of agitated state that can lead to unexpected death. The 2009 "White Paper Report on Excited Delirium Syndrome," authored by the American College of Emergency Medicine (ACEP) Excited Delirium Task Force, continues to play a pivotal role in defining ExD. Since that report was produced, there has been an increasing appreciation that the label has been applied more often to Black people.

Methods: Our aim was to analyze the language of the 2009 report, the role of potential stereotypes, and the mechanisms that may potentially encourage bias.

Results: Our evaluation of the diagnostic criteria for ExD proposed in the 2009 report shows that it relies on persistent racial stereotypes: eg, unusual strength, decreased sensitivity to pain, and bizarre behavior. Research indicates that use of such stereotypes could encourage biased diagnosis and treatment.

Conclusion: We suggest that the emergency medicine community avoid use of the concept ExD and that ACEP withdraw implicit or explicit support of the report. [West J Emerg Med. 2023;24(2)152–159.]

INTRODUCTION

As emergency physicians, we want our patients to be treated humanely, and we want our staff and ourselves to end our shifts healthy and uninjured. Evaluation of the patient with severe agitation or "excited delirium" (ExD) requires us to carefully balance those goals, given the heightened risk of significant harm to the patient, the healthcare worker, or even both. A large amount of research has been directed at clarifying issues of diagnosis, pathophysiology, and best practices for treatment in these situations. The 2009 "White Paper Report on Excited Delirium Syndrome" authored by the American College of Emergency Physicians (ACEP) Excited Delirium Task Force, is a touchstone of that literature.[1] However, there is an increasing awareness of the evidence that Black men receive the diagnosis of ExD more often than White men, and that Black men labeled as having ExD have a higher mortality than White men: Most recently, a report released by Physicians for Human Rights in March 2022 highlighted these concerns, attracting coverage from national news media.[3]

At the same time, the emergency medicine (EM) community, including ACEP, has made equitable treatment of patients a priority, including recognition of the role that implicit bias exerts in EM.[4] A statement from ACEP described the death of George Floyd as a manifestation of a "public health emergency,"[5] and affirmed that "ACEP's mission includes the promotion of health equity within the communities we serve." They concluded: "The fate of our

nation's public health and safety lies in the balance, and we demand change."

Clearly, it is imperative to identify the factors that may be contributing to this disparity in ExD diagnosis and outcomes and seek ways to address them. We raise the possibility that the language used in that influential 2009 ACEP report has contributed to biased application of the diagnosis and inequitable outcomes of Black patients. We analyze that language of the 2009 report, the role of potential stereotypes, and the mechanisms that may potentially encourage bias. We will conclude with suggestions to redress those issues.

Population Health Research Capsule

What do we already know about this issue?
The controversial diagnosis of Excited Delirium (ExD) is disproportionately applied to Black individuals.

What was the research question?
Do criteria in the 2009 ExD report from the American College of Emergency Physicians reflect or promote bias?

What was the major finding of the study?
ExD was defined using racial stereotypes, and could reinforce inequitable diagnosis and harm.

How does this improve population health?
A rejection of the diagnosis of ExD by emergency medicine organizations could reduce patient injury and death, particularly in Black individuals.

The 2009 and 2021 ACEP Task Force Reports

The 2009 "White Paper Report on Excited Delirium Syndrome" (2009 report) authored by the ACEP Excited Delirium Task Force,[1] has played a prominent role in the discussion about deaths of people in police custody or in medical care. The report is regularly cited in academic literature and popular media.[6] Although it was not published in a medical journal, the document has been readily available through various outlets.[7]

The 2009 report described ExD as "a unique syndrome which may be identified by the presence of a distinctive group of clinical and behavioral characteristics." Such patients were typically "hyperaggressive with bizarre behavior, … impervious to pain, combative, hyperthermic and tachycardic." Other key features noted were a "failure to recognize or respond to police presence at the scene …, erratic or violent behavior, [and] unusual physical strength and stamina." They highlighted the often-fatal course of this syndrome, where "a struggle with law enforcement [is] followed by a period of quiet and sudden death." The report was explicitly written to inform both medical personnel and law enforcement officers.

A different ACEP task force has since produced the "ACEP Task Force Report on Hyperactive Delirium with Severe Agitation in Emergency Settings" (2021 report).[2] The authors state that their document was not intended as an "update or refutation" of the 2009 report. Nonetheless, the 2009 report is referenced, and literature regarding "excited delirium" is cited throughout, including papers both preceding and subsequent to the 2009 report. The 2021 report was approved by the ACEP board of directors, while the 2009 report carries no similar endorsement.

A Continuing Lack of Clarity in Defining "Excited Delirium"

The criteria used to identify or diagnose ExD have not been clearly established. Aside from the National Association of Medical Examiners, no other leading medical organizations have adopted ExD as a formal diagnostic entity. The American Medical Association (AMA) and the American Psychiatric Association (APA), by contrast, have opposed recognition of this diagnosis. The APA has noted that ExD is "too non-specific to meaningfully describe and convey information about a person."[8] Similarly, the AMA has issued a statement that ExD lacks a "clear set of diagnostic criteria."[9] Lastly, while ACEP is often understood to have "officially recognized" ExD, the College clarifies that the 2009 report was an "information paper that was not officially endorsed by ACEP."[10]

Aside from formal recognition by medical societies, the literature has not provided a better definition of ExD than was offered in the 2009 report. A number of studies have reiterated the criteria offered by Hall in the 2009 report, including subsequent publications co-authored by Hall herself.[11–13] By contrast, a recent study examining a ketamine treatment protocol for ExD in the emergency department (ED) did not describe the authors' diagnostic criteria, noting only that there is "no current standardized case definition."[14] A study of agitation in ED patients remarked that ExD as a medical entity, "remains largely theoretical."[15] One study examined cases in which a police officer had identified ExD, but the diagnosis was not defined or adjudicated.[16] Given the lack of consensus in defining ExD, it is not a surprise that the terms and criteria from the 2009 report continue to be employed.

Excited Delirium Is a Health Equity Issue

There are decades of evidence demonstrating that young Black males are disproportionately affected by the label of ExD. Some of this evidence was available to the 2009 task force, with four of the studies cited in their report demonstrating disproportionate rates of diagnosis and mortality in Black individuals with ExD. Two of those looked at deaths in South Florida: Ruttender et al found that individuals who died from ExD vs accidental cocaine overdose were more likely to be

Black.[17] Mash et al later found a similar racial disparity in results.[18] Grant et al found that Black individuals constituted 63% of the ExD deaths in custody.[19] Stratton et al looked at deaths in people while they were restrained with wrists and ankles secured together behind the back, and labeled as ExD.[20] They found a numerically equal number of deaths in White and Black people; however deaths in Black individuals were higher relative to the population.

The literature subsequent to the 2009 report has also suggested biased application of ExD. A meta-analysis by Gonin et al concluded that being a Black person was an independent risk factor for death in people labeled with ExD.[21] Not only do Black individuals seem to be at higher risk of death with ExD than White individuals, they are also diagnosed in non-lethal cases at a higher rate. Strote et al found that Black individuals represented 56% of the ExD cases in one city, while only 35% were White.[16]

Absent from the 2009 and 2021 reports is a substantive discussion of the potential inequitable application of the diagnosis of ExD to Black individuals, and especially Black men while in police custody or under the care of emergency medical services (EMS) care. This issue was unaddressed in the 2009 report, despite findings known at the time. In contrast with the ACEP reports, the popular press has directed increasing attention to the issue of bias and ExD. News reports critically examined the concept of ExD, including racial aspects, after the diagnosis of ExD was advanced by the legal defense team[22] and the police [23] to explain the deaths of George Floyd and Elijah McClain, respectively. National newspapers have published opinion pieces regarding bias in ExD as well.[24]

Despite the medical evidence and the attention in the lay press, the 2021 report only briefly touches on the racial disparity in identification and mortality. The authors cite three of these studies mentioned above, and recognize this disproportionate effect on Black individuals.[16,19,20] The 2021 report notes that it may be the case that "differential assessment occurs because persons of color more frequently have dangerous encounters with law enforcement." This ambiguous wording emphasizes a central aspect of this issue: It may be that Black men are labeled with ExD more often because they interact with law enforcement more frequently. However, it may also be that these men are more often suspected of being dangerous because of an inherently biased conception of ExD.

Similarly, it could be argued that a disproportionate rate of ExD in Black individuals might be simply explained by a disproportionate rate of use of stimulant drugs (eg, powder and "crack" cocaine, phencyclidine, methamphetamine). However, Black individuals seem somewhat less likely to use cocaine or methamphetamine than White individuals.[25] The 2020 National Survey of Drug Use and Health looked at rates of use of powder and crack cocaine, hallucinogens, methamphetamine, prescription stimulants, and central nervous system stimulants among Black and White individuals.[26] Overall, the rate of use of these drugs in the White population exceeded that in the Black population with regard to lifetime use, or in the prior year and prior month use. For example, the 2020 rate of lifetime use of crack cocaine in the age group 18+ years old was marginally higher in the Black population vs the White population (4.4 % vs 4.1%, respectively). However, the Black population in this same age group had a far lower lifetime rate of methamphetamine use than the White population (2.3% vs 7.3%), and this difference was even more marked for lifetime powder cocaine use (9.6% vs 18.6%). And while the rate of crack cocaine use was marginally higher in the Black population, the absolute number in 2020 of White people 18+ years old reporting lifetime crack use (about 6.5 million people) dwarfs that of the Black population (about 1.3 million).

While Black individuals are not, overall, more likely to use cocaine (powder or crack) than White individuals, they are more likely to be arrested for their use of drugs.[27] This appears to be driven by differential use of powder cocaine by White individuals, frequency of use, and socioeconomic factors. However, while a higher rate of arrests for crack cocaine use in Black individuals might explain the higher rate of ExD diagnosis in that population, this would ignore the role of systemic racial biases leading to higher rates of arrest and public perceptions about drug use and crime.[28,29]

Regardless of the rate of drug use in either population, drug use is numerically higher in the majority White population. Despite this, common criteria for ExD have used biased language that reiterate racial stereotypes.

Racialized Criteria for Diagnosis

We argue that a central problem with the criteria for ExD proposed in the 2009 report is the use of language that elicits and reinforces racial stereotypes. We argue that a central problem with the criteria for ExD proposed in the 2009 report is the use of language that elicits and reinforces racial stereotypes. These stereotypes are particularly notable in three of the diagnostic criteria that the 2009 report employs: "unusual" or "superhuman" strength; reduced sensitivity to pain or "impervious"; and "hyperaggressive" (sic) or "bizarre" behavior.

First, the 2009 report describes the patient with ExD as possessing "unusual" or "superhuman" strength. This is uncommonly subjective language for a medical description, but this criterion has remained a standard element of ExD. Even a recent study (cited within the 2021 report) uses "lack of tiring [or] unusual strength" as inclusion criteria for ExD.[30] However, Black individuals have long been stereotyped as possessing significant physical strength and stamina, especially when compared with White individuals.[31–33] Even when the actual strength of the subject is controlled for, Black men are perceived as stronger than White men.[34] The description of "superhuman" strength has an especially freighted racial

history. A significant proportion of Americans implicitly and differentially ascribe superhuman or fantastical qualities, including "superhuman" strength," to Black individuals.[35]

The authors of the 2021 report appropriately avoid reinforcing the term "superhuman," preferring the term "indefatigability." They offer that indefatigability is "commonly misinterpreted as 'superhuman strength,'" but do not explain how that misinterpretation arose. We do not believe that the characterization of "indefatigability" is sufficiently distinct from "superhuman strength," and may still promote a racially biased conception of ExD. This distinction may be irrelevant, however, as "superhuman strength" continues to be used as a criterion in recent studies of ExD.[36]

Second, the 2009 report describes a decreased sensitivity to pain as a central and common characteristic of individuals with ExD. The authors caution that individuals with ExD may have a characteristic "pain tolerance," making it more likely that control measures that rely on "pain compliance" may fail. An unfortunate but persistent stereotype is that Black individuals are believed to feel less pain than White individuals.[33,37,38] These beliefs are held not only by lay people, but even by medical students[38] and nurses.[39]

The 2009 report describes not just a higher tolerance for pain in individuals with ExD, but an inability to feel any pain whatsoever: the phrase "impervious to pain" is used three times. Troublingly, Black individuals have been stereotyped as possessing just such a supernatural capacity to feel no pain. This "superhumanization" stereotype—that Black individuals may feel less or no pain— has roots in the era of slavery ("What would be the cause of insupportable pain to a white man a Negro would almost disregard"[32]) and remains widely held.[35]

Lastly, the 2009 report uses behavioral abnormalities as key diagnostic features for ExD: The subject may be "hyperaggressive," "erratic," or show "destructive or bizarre" behavior, and may vocalize "guttural sounds." There is ample literature showing that people view Black individuals as more irrational, animalistic, and dangerous than White individuals.[32–34] Black patients are restrained at a higher rate in EDs than are White patients, suggesting an implicit bias in perception of dangerousness.[40] This bias is even shared by psychiatric workers.[41]

These stereotypes of unusual or "superhuman" strength, reduced or "impervious" to pain, and "hyperaggressive" behavior, constitute key features of ExD in the 2009 report. We are concerned that the use of this language may encourage the biased diagnosis and treatment of ExD in two manners. First, this language could preferentially evoke the image of a Black male. The tropes of "superhuman," "impervious," and "hyperagressive (sic)" have so long been associated with that population that their use here could lead to implicit association of the diagnosis with Black individuals. This use of Black faces or of stereotypically Black words has been shown to do just this in research settings. "Priming" with subliminal cues (eg, words associated with "Black" words, or a Black individual's face) can promote racially biased judgments in both police officers[42] or therapists,[43] even in scenarios where race is not explicitly mentioned.

Conversely, being presented with a Black person's face may trigger biased perceptions. In a research setting, participants were far more likely to assign superhuman strength or pain tolerance to faces of Black people compared to White people.[35] Medical workers are subject to the "representative" heuristic, where certain incidental aspects of a case may lead the unwary clinician to prematurely assign a diagnosis.[44] For example, a study enrolling nurses found they were more likely to ascribe the presentation of chest pain or stroke to a less concerning diagnosis if suggestions of depression or alcohol use were introduced into the scenario..[45] Even a subliminal exposure to the face of a Black individual, displayed too quickly to be consciously registered, might trigger associations with certain diseases, even in physicians.[46] Given this evidence, it could be the case that EMS workers may be led to apply the label of ExD when presented with a Black patient vs when presented with a White patient. Further studies could address this.

The use of racialized terms and images in the 2009 report do not suggest any conscious or explicit bias on the part of the authors. Healthcare workers can manifest certain biases even in the absence of conscious bias.[47] Furthermore, these biases can be exacerbated in the stressful conditions and time pressures of the healthcare environment.[48–50] Our criticism of the 2009 report should not be misunderstood as an accusation of explicit bias on the part of the ACEP task force members.

"Just semantics?"

The issues we describe with ExD may strike many as "just semantics," with concerns resolved through simple substitution of the term. The writers of the 2009 report argued that even if the term of ExD was not accepted by other organizations, other diagnoses "describe the same entity as [excited delirium syndrome], albeit with different wording."[1] Likewise, a recent controversial presentation prepared by an emergency physician for police training was titled "~~Excited Delirium~~ Severe Agitation with Confusion (Delirium),"[51] where the use of the strikethrough suggested that only a superficial name change was needed.

However, issues of semantics, by definition, involve differences in meaning, and this is no less true with diagnostic labels. The authors of the 2009 report note that there were several widely accepted and applicable alternative diagnostic labels available. Nonetheless, they felt that the distinct label of "excited delirium" should be applied, and that the features of "superhuman strength," "hyperaggressive with bizarre behavior," and "impervious to pain," were key elements of that entity. The semantics were important to the authors and remain so now.

The authors of the 2021 report write that this discussion over the term ExD is increasingly irrelevant, as the

"increasingly charged term" is less often used in favor of more descriptive terms. Nevertheless, the authors recommend that "robust documentation" of patient death, presumably by emergency physicians or other clinicians, can support the medical examiner in determining whether death was due to ExD. In this manner, far from acting as an update or revision of the 2009 report, the 2021 report reinforces the concept and language of ExD, even as one author of the report states that ExD "is on its way out as a diagnostic term."[52]

Additionally, the term ExD endures in academic literature,[14,30,36] and within police[53] and EMS[54] training materials. As we write this, the mayor of a major city has become involved in a controversy regarding the police force, an academic medical center, and police training materials prepared by emergency physicians using the term "excited delirium."[51] Lastly, emergency physicians providing expert witness testimony in court continue to authoritatively cite the 2009 report in, for example, depositions for civil cases decided in 2020,[55] 2021,[56] and for a grand jury testimony in 2021.[57] It is reasonable to expect that the 2009 report will remain relevant for some time if not challenged.

A Constructive Way Forward - Four Actions

1. **Emergency medicine should avoid the concept of "excited delirium."**

The discussion above has shown that the conception of ExD has roots in racist language and imagery. There is little medical evidence that supports a distinct entity of ExD, while there is growing evidence that the label is associated with health inequities. Thus, there is no basis to use this label over more established medical diagnoses. And indeed, there is evidence that the term is associated with patient harm. Simply replacing the label ExD with another term would not be sufficient.

Any diagnostic label that relies on criteria emphasized in the 2009 report (eg, "unusual" strength, "impervious to pain, or "hyperaggressiveness") should be considered to be equivalent to ExD, despite any superficial name changes.[51] The emergency medicine community has already begun to eliminate ExD as a valid medical label. The Colorado Department of Public Health & Environment released a report in December 2021 that could serve as an example of a more equitable approach.[58] The Ketamine Investigatory Review Panel, convened in response to the death of Elijah McClain, was chiefly composed of authors and reviewer experts from EM and EMS. The report rejected ExD as a diagnosis, suggested best practices for identification and treatment of dangerously agitated patients, and called for a research agenda to study inequitable use of prehospital sedation. Similarly, in April 2022 the American Academy of Emergency Medicine issued a position statement that ExD is not currently supportable as a medical diagnosis and should not be identified as a cause of death.[59]

We would encourage other EM organizations (eg, the Society for Academic Emergency Medicine, the National Association of EMS Physicians, ACEP, the Canadian Association of Emergency Physicians) to examine the problematic conception of ExD and reject it as a valid diagnosis.

2. **Clinicians Should Use Established Medical Diagnoses.**

We have highlighted that concerns about ExD cannot be addressed by a simple name change. We suggest that standard diagnostic labels be employed. For example, the APA has noted that "Delirium, hyperactive subtype" from their Diagnostic and Statistical Manual (DSM) captures many elements of a patient's presentation,[8] but without the stereotyped language of ExD. The authors of the 2021 ACEP report use similar language of "hyperactive delirium with severe agitation," although they do not refer to DSM criteria or provide their own definition.[2] We suggest that clinicians use such a diagnostic structure in lieu of ExD.

3. **ACEP Should "Retire" the 2009 Report.**

ACEP has clarified that the 2009 report was produced as an "information paper" but was not officially endorsed by ACEP (personal communication[10]). However, there exists an understanding that ACEP "formally declared" the existence of ExD[60] or that ACEP had "formally recognized" ExD.[61] This language of "formal" recognition by ACEP has been repeated in EM trade publications[62] and even on the ACEP website.[63] While ACEP has not formally endorsed the 2009 report, neither has the college corrected any such mischaracterizations. The 2021 report did not aim to accomplish this, and the authors of that paper were explicit that their work "is de novo and not to be construed as an update or refutation of the 2009 paper."

We suggest that ACEP formally withdraw acknowledgment of the 2009 report. This should be followed by proactive engagement, to correct mischaracterizations of "formal" or "official" status of the 2009 report. Such efforts would comprise clear communication with editors of academic medical journals, as well as outreach to lay media. Furthermore, emergency physicians working as expert witnesses in civil or criminal litigation should be directed to avoid describing or implying any ACEP "endorsement" or "recognition" of ExD.

4. **Consider Greater Professional and Racial Diversity in Future Panels.**

We should not preclude further efforts to discuss the label of ExD by ACEP or other organizations. It is possible that future evidence could support a distinct diagnostic label. As we have discussed, there are significant issues of bias that complicate the concept of ExD. Thus, a wider range of perspectives need to be represented in a future task force.

First, such a task force of emergency physicians and other stakeholders should include those with expertise in not only EMS and toxicology, but also neurology, emergency psychiatry, and health equity. A wider range of community and

advocacy leaders should also be considered.[64] Second, a future task force should include a broader racial perspective.[65,66] The recent release of the Ketamine Investigatory Review Panel Report by the Colorado Department of Public Health & Environment can serve as an example of professional, racial, and ethnic diversity.[58]

CONCLUSION

Emergency medicine and ACEP, specifically, has committed to recognizing and addressing structural racism and working to ensure equitable treatment of patients. Identification and management of the severely agitated patient is a key challenge in EM, with such patients often described as being in a state of excited delirium. The evidence shows, however, that Black people are differentially labeled with ExD, seemingly dying at a higher rate than White people. Despite concerns about the diagnosis of ExD, the 2009 ACEP report on ExD continues to be used and cited as an important resource, viewed by some as an "official endorsement" of ExD by ACEP. We have found that the report uses racialized language and imagery to define ExD and that such framing may encourage biased care of agitated patients. We conclude that emergency physicians should avoid this diagnostic concept, and researchers should adopt more established criteria when studying agitation and delirium. Lastly, we urge that ACEP actively rescind any explicit or implicit endorsement of the 2009 report. This position should be communicated to law enforcement organizations and to expert witnesses testifying in relevant civil and criminal litigation.

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Emergency Physician Observations and Attitudes on Law Enforcement Activities in the Emergency Department

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Introduction: Law enforcement officers (LEO) interact with patients and clinicians in the emergency department (ED) for many reasons. There is no current consensus on what should comprise, or how to best enact, guidelines that ideally balance LEO activities in the service of public safety with patient health, autonomy, and privacy. The purpose of this study was to explore how a national sample of emergency physicians (EP) perceives activities of LEOs during the delivery of emergency medical care.

Methods: Members of the Emergency Medicine Practice Research Network (EMPRN) were recruited via an email-delivered, anonymous survey that elicited experiences, perceptions, and knowledge of policies that guide interactions with LEOs in the ED. The survey included multiple-choice items, which we analyzed descriptively, and open-ended questions, which we analyzed using qualitative content analysis.

Results: Of 765 EPs in the EMPRN, 141 (18.4%) completed the survey. Respondents represented diverse locations and years in practice. A total of 113 (82%) respondents were White, and 114 (81%) were male. Over a third reported LEO presence in the ED on a daily basis. A majority (62%) perceived LEO presence as helpful for clinicians and clinical practice. When asked about the factors deemed highly important in allowing LEOs to access patients during care, 75% reported patients' potential as a threat to public safety. A small minority of respondents (12%) considered the patients' consent or preference to interact with LEOs. While 86% of EPs felt that information-gathering by LEO was appropriate in the ED setting, only 13% were aware of policy to guide these decisions. Perceived barriers to implementation of policy in this area included: issues of enforcement; leadership; education; operational challenges; and potential negative consequences.

Conclusion: Future research is warranted to explore how policies and practices that guide intersections between emergency medical care and law enforcement impact patients, clinicians, and the communities that health systems serve. [West J Emerg Med. 2023;24(2)160–168.]

INTRODUCTION

Background

The emergency department (ED) holds a unique position at the intersection of health and society. It is the "safety net" infrastructure for acute healthcare systems across the United States (US) and a frequent entry point into healthcare institutions.[1] As such, it is often a window into the health impacts of social, economic, and political challenges faced by individuals and in communities.[2] Many injuries and illnesses treated in the ED attract responses from law enforcement officers (LEO) and the larger criminal legal system. While any individual seeking care in the ED may encounter LEOs, direct contact is most common for individuals who have health emergencies associated with violence, alcohol or drug use, and psychiatric concerns, individuals under arrest or incarceration, and individuals who are identified as undocumented immigrants.

Importance

Law enforcement officers can play multiple roles in the ED, and these vary widely by institutional and community context. They provide security and respond to calls for service from hospital staff. They may oversee patients in law enforcement custody; provide transport to the hospital; collect evidence; take accident, incident or crime reports; document injuries; and in some cases patrol crowded ED waiting rooms to maintain order.[3,4] While the activities, protocols, and priorities of LEOs are generally informed by their mission to maintain public safety, the scope, legality, and details of their encounters with patients may not be well understood by healthcare personnel who are responsible for providing care to patients or by healthcare administrators who set policies and guidelines for their institutions.[3]

Scholarship on the overlap between ED care and law enforcement activity is relatively new in medical and legal studies. In her recent article in the *Harvard Law Review*, legal scholar and law professor Ji Seon Song examines the social and legal context of how policing affects people in the ED.[5] Song reports that courts have interpreted the ED as an extension of the public arena, generally allowing police to engage in the searching and questioning of patients with only the same constraints as would apply on a city street. Song argues that this doctrine does not account for the medical vulnerability of patients in the ED and that it exacerbates racialized policing practices due to the convergence of police and marginalized groups, namely Black and other minority patients and poor patients, in safety-net EDs.

Some law enforcement activities may in fact conflict with the clinical priorities of emergency physicians (EP), nurses, and staff who are tasked with initiating life- and limb-saving interventions. Additionally, LEOs' goals to maintain social order and enforce laws may clash with ethical imperatives that guide the practice of medicine, such as respect for individual autonomy, expectation of privacy, and the principle of non-maleficence.[6] These conflicts may lead to violations of patient privacy, erosion of trust, and compromised clinical care.

Population Health Research Capsule

What do we already know about this issue?
Clinical and ethical priorities to guide patient care intersect and may conflict with priorities of law enforcement officers (LEO) in the emergency department (ED).

What was the research question?
How do emergency physicians (EP) perceive law enforcement activities during emergency medical care?

What was the major finding of the study?
The majority (62%) perceived LEO presence as helpful for clinicians, 75% reported patients' potential threat to public safety was highly important in allowing LEOs to access patients, and 86% felt that information- gathering by LEO was appropriate in the ED.

How does this improve population health?
The lack of consensus among EPs on LEO activity in the ED highlights the need for policies that optimally protect patients while securing public safety.

Goals of This Investigation

Despite these complexities, there is sparse legal or institutional policy to guide EPs and other clinicians in these areas of potential conflict, leading to ad hoc, informal negotiations and decisions. The American College of Emergency Physicians (ACEP) released a position statement on law enforcement information-gathering in the ED, affirming that the EP's fundamental responsibility is to patients and specifies the circumstances in which EPs may provide LEOs with patient information.[7] However, research on the frequency and perceived impact of LEO presence in the ED and interactions with patients during clinical practice is sparse. In this study, we sought to explore the perceptions and policy knowledge of a national sample of EPs relevant to the activities of LEOs during the delivery of emergency medical care.

METHODS

Study Design and Setting

In collaboration with leadership from ACEP, the Emergency Medicine Practice Research Network (EMPRN) is a voluntary group of 765 EPs representing a broad-spectrum emergency practice who are asked to complete up to four surveys a year. A wide variety of topics are covered in the

questions posed to EMPRN participants, who closely mirror the national ACEP membership in terms of gender, age, years in practice, geographic region, and practice level. We developed a survey instrument to elicit information on their experiences with and perceptions of LEOs in the ED (provided in full in Appendix A). In March 2021, this survey and three other distinct surveys were distributed via an emailed link to an online survey platform to the full membership of 765 EPs in the EMPRN. The ACEP staff compiled response data and sent our research team a limited dataset containing responses to our survey for analysis. The institutional review board at the University of Pennsylvania approved this study, and the EMPRN research section reviewed the survey instrument.

Analysis

We descriptively analyzed the survey data, generating frequency counts and percentages of respondents who responded to each survey item. Open-ended questions were used to elicit respondents' views of prominent barriers and facilitators to policy development and implementation for LEO activities in the ED in their practice setting. We coded this data using content analysis. The reliability of the coding scheme was supported by using two independent coders and coding comparison, wherein any discrepancies or differences in interpretation were rectified by research team review and consensus.

RESULTS

Characteristics of Study Subjects

The survey was completed by 141 of 765 EPs (18.4%). Of those respondents, 113 (82%) were White and 114 (81%) were male. Respondents were diverse in age and geographic location (see Table 1 and Appendix Figure 1). This broadly reflects the demographics of current ACEP membership, 26% of whom are women, and 1% and 1.5% of whom are Black or Hispanic, respectively.

Table 1. Demographic characteristics of respondents.

	N	Percent
Region		
Northeast	27	19%
Southeast	33	23%
Southwest	22	16%
Midwest	34	24%
West	25	18%
Age		
Under 35	1	1%
35-45	39	28%
46-55	43	31%
56-65	40	28%
Over 65	18	13%
Race and ethnicity		
Asian	5	4%
Black or African American	1	1%
Hispanic or Latino	1	1%
Other	14	10%
Two or more races	3	2%
White	113	82%
Gender		
Female	27	19%
Male	114	81%

Survey Results

When asked how frequently EPs observe LEOs interacting with ED patients, more than one third (34%) responded daily, 26% responded several times a week, and 21% responded weekly. Regarding the observed activities of LEOs in the EDs, respondents most commonly reported they observed LEOs accompanying a patient under arrest; accompanying a patient who was agitated, altered or intoxicated; or accompanying a patient who was incarcerated or jailed. More than three-fourths reported they had observed patients being questioned in the ED as a witness to a crime (78%) or a suspect in a crime (77%). (See Figure 1.)

Survey respondents described the presence of LEOs as usually or almost always helpful to their clinical work 62% of the time, while less than 2% perceived LEO presence as usually or almost always harmful to their clinical work. More specifically, respondents viewed LEO presence during clinical care as being helpful or very helpful for patients 38% of the time, for clinicians 59% of the time, and for public and community safety 65% of the time. On the other hand, respondents described LEO presence during the care of ED patients as somewhat harmful or harmful for patients 10% of the time, for clinicians 2% of the time, and for public and community safety 2% of the time.

There was little consensus among respondents in perceptions of how LEO presence affects multiple considerations in emergency care provision. For example, while 21% of respondents reported that LEOs very positively or somewhat positively affect clinician-patient rapport, 32% of respondents reported that the effect was somewhat or very negative. Similarly, on the topic of clinical throughput and quality of care, 28% reported a somewhat or very positive effect while 21% reported a somewhat negative effect. There was agreement on the effect of LEO presence on the surrounding community's trust in the healthcare institution and the healthcare institution-police system relationship, as the majority of respondents reported positive impacts on both (See Figure 2).

When EPs were asked about the factors highly important to determining whether to allow or not allow LEOs access to their patients, 56% of EPs reported the severity of the patient's condition, 75% reported the patient's potential as a threat

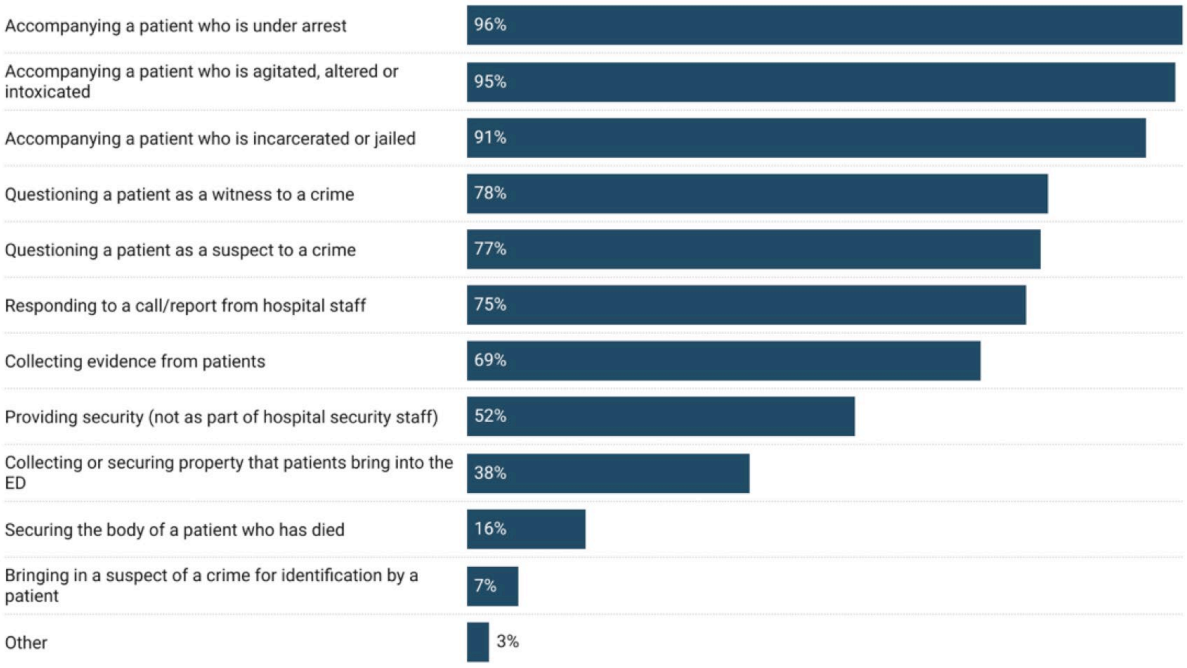

Figure 1. Law enforcement officer activities observed by emergency physicians in the emergency department.

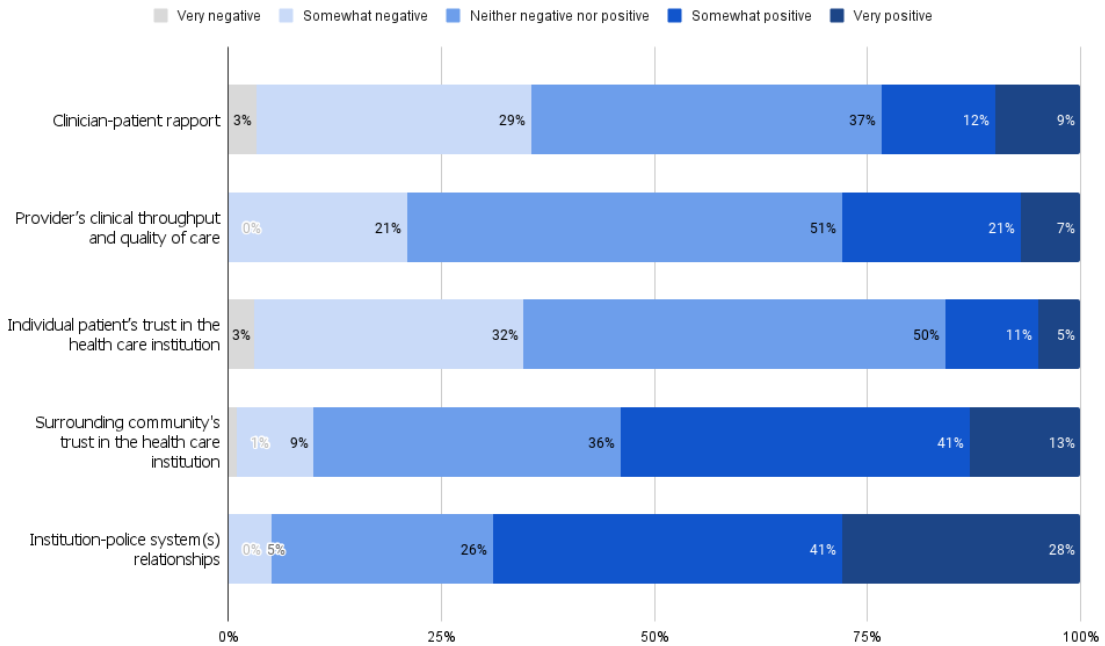

Figure 2. Emergency physician perceptions of the impact of law enforcement officer activity on clinical and community relationships.

to public safety, and 80% reported the safety of ED staff as being highly important. On the other hand, 24% thought that a patient's ability to provide informed consent to interact with LEOs was highly important, and only 12% considered the patient's willingness or preference to interact with LEOs as highly important (See Figure 3).

Regarding appropriateness of information-gathering about a crime or suspected crime (when safety of staff or patients is not explicitly a concern), 86% of EPs felt that it was appropriate to do so in the ED after initial work up. Only 3% reported that LEOs should not interact with patients in patient-care areas of the hospital. When asked whether they felt they had oversight or influence over LEO access to patients in the ED, EPs responded affirmatively only 54% of the time. Only 13% of EPs responded that they were aware of a policy or guideline to inform LEO interactions with ED patients. Nearly

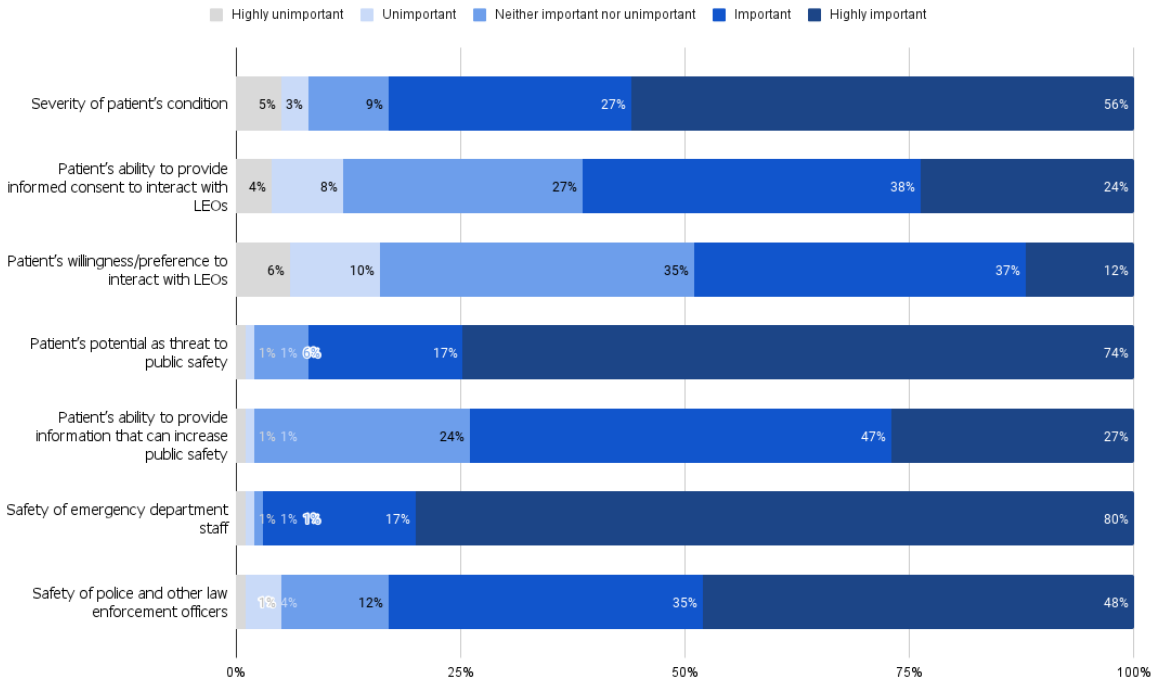

Figure 3. Factors influencing the emergency physician's decision to allow law enforcement access to emergency department patients. *LEO,* law enforcement officer.

half (48%) of respondents reported they did not foresee any barriers to routine adherence, were a policy to be enacted in their ED.

Content Analysis Results

Content analysis identified barriers and facilitators to the development and implementation of institutional policies to guide LEO activity in the ED. Five categories of barriers to policy development and adoption were identified: 1) public safety; 2) enforcement concerns; 3) difficulties related to standardization; 4) education and communication of policy; and 5) need for leadership buy-in (described in Table 2). *Public safety* referred to expressed reluctance to enforce an institutional policy that would impede the activities of LEOs. Participants raised the concern that interfering with law enforcement work could interfere with the promotion of public safety interests. *Enforcement concerns* reflected participants' concerns that even if a policy were to exist to guide the activities of LEOs in the ED, enforcement would be challenging. Many respondents raised concerns over who in the ED would be left with the burden of enforcing the policy, and some predicted that LEOs would ignore the policy even if one existed. *Difficulties related to standardization* recognized that the nuanced nature and diverse drivers of LEO activity in the ED would be difficult to capture in a single policy. In this category, respondents raised concerns that drafting an overarching policy would be difficult due to the unique situations that arise and the time-sensitive nature of LEO activities. *Education and communication of policy* reflected the perceived barrier that policy adherence would be limited by capacity for policy knowledge dissemination. Respondents noted that trainings and education about the policy among both ED staff and LEOs would be necessary. Finally, respondents communicated that *leadership buy-in* would be required for effective adoption and enforcement of a policy within both hospitals/healthcare institutions and LEO organizations.

Very few facilitators were identified. The facilitators that were endorsed referred to specific categories of personnel: 1) ED staff (physicians, nurses and other staff); 2) hospital administration; 3) hospital security; 4) LEOs; and 5) social workers. Responses to this question consisted of predictions by respondents on which groups of individuals would be most helpful in implementing a new policy. Interestingly, unlike the multidimensional barriers described in the previous section, respondents did not list non-personnel facilitators to policy adoption (Table 2).

DISCUSSION

To our knowledge, this is the first study in which a national sample of emergency physicians identified their observations and perceptions on the presence of law enforcement in the ED. The majority of respondents reported that in their experience, there was a regular and frequent (daily or weekly) presence of LEOs in the ED. Most reported that law enforcement presence was helpful to clinicians in the ED as opposed to only 38% who felt it was helpful to patients. The majority of EPs also felt that information-gathering by LEOs was appropriate in the ED setting,

Table 2. Perceived barriers and facilitators to policy implementation.

Barriers to policy adherence	Description	Exemplar quote(s)
Public safety	Interfering with police work could harm public safety	"If a crime has been committed and the police need to interact with a patient to get information for public safety, then this is an emergent issue (just as emergent as the patient's medical issues being emergent). If there was a policy where police could not interact with patients when a crime has been committed, this can be a danger to others in our area (like if a patient was stabbed or shot, and now a potential murderer needs to be found before they hurt someone else)."
Enforcement concerns	Concerns about how and who would enforce policy and whether police would respect policies from within healthcare organizations	"Police often are quite intimidating and cite the reasons they need to access patients and why rules do not apply to them. Standing up to police often results in lots of headache."
		"Police ignore it and staff can't do anything about it."
Difficult to standardize	Comments on unique situations, and the nuance of emergency setting, which makes creating an applicable and coherent policy difficult	"Cases vary widely and a policy could not cover every scenario, so would be hard to adhere to."
Education/communication of policy	Concerns about adequate trainings for clinicians and police and communication of policy between hospital and LEO administration	"Lack of communication to the actual officers so they won't even know the policy"
		"Providers not knowing the policy and applying it inconsistently"
Leadership buy-in	Concerns regarding the extent to which hospital leadership and administration and LEO leadership and administration would invest in new policy	"If there is no ED leadership involved in creation of the policy barriers will occur. Hospital regulatory and risk do not fully understand the ED environment, especially an environment that can feel like a war zone at times with the amount of violence and trauma seen."
		"Unless mutually agreed to in advance by law enforcement and hospital it can lead to increased tension and conflict at the point of care in the ED."
Facilitators to policy adherence	**Description**	**Exemplar Quote(s)**
Personnel	Categories of ED personnel who would aid in adoption and dissemination of an institutional policy	"Nursing staff very much advocate for enforcing written hospital policy."
		"Triage nurse or hospital security would help enforce."
		"ED physician and nursing management, law enforcement representatives"
		"We would need help at several levels--legal, risk management, law enforcement."

especially after completion of a patient's initial work-up. The meaning behind this difference is beyond the purview of this study but may be influenced by the demographic and experiential context of the cohort that completed the survey. Respondents reported primarily non-Hispanic White and male identities and, thus, the perceptions of LEOs' activities in the ED may be bounded by their racialized and gendered experiences with LEOs in day-to-day life. Our sample of surveyed EPs was more homogenous than the racial/ethnic composition of practicing EPs and the general US physician workforce, who are estimated to be 69%-73% and 56.2% White, respectively.[8-10] Our study results should be considered within the context of known racial/ethnic discordance between mostly White EPs and the more racially diverse ED patients they serve.

While EPs in our sample endorsed that they had at least some authority to direct LEO access to patients, only 13% were aware of extant policy through which to guide their decisions. The most common factor EPs cited as determinant of authorizing access to patients was the patient's potential as a threat to public safety. In 2022, ACEP conducted a survey to enumerate the extent of violence exposure that EPs face in the ED. Survey results indicated that EPs have an increased perception of risk of violence posed by patients but do not describe trainings or standardized education that would help them judge and report this risk, highlighting the need for explicit guidance for how and when to engage LEOs.[11]

The facilitators and barriers cited in our results in relation to theoretical policy implementation identify important considerations for building clarity and communication in this area. All respondents listed multiple personnel in the ED who could serve as potential facilitators to the enforcement of policy, for example, triage nurses or physicians. On the other hand, barriers were cited across multiple domains including enforcement, leadership, education, operational challenges, and potential consequences. Doubtless, effective policy in this area must be multidisciplinary and collaborative to appropriately incorporate the interests of patient, clinicians, and law enforcement.

The social context of policing and healthcare in the communities frequently served by the ED is another consideration in policy development, even if implemented in a way that overcomes common barriers. Survey respondents in our study endorsed that LEOs in EDs have a positive influence on the community's trust in the healthcare institution. This perception prompts the need for additional exploration. Emergency physicians generally have limited information through which to gauge how the communities that use the ED perceive law enforcement presence concurrent in emergency care, other than anecdotal reports. While we could not evaluate the interpretation of how law enforcement presence moderates patient and community trust, it is critical to understand the social meaning of intersections between the healthcare and law enforcement sectors and the communities that both serve.

The way different communities regard healthcare institutions and law enforcement agencies is highly dependent on collective and individual, as well as historical and contemporary experiences. Racialized assumptions that Black Americans are prone to criminality, for example, have been shown to pervade and impact healthcare encounters.[12,13] Assumptions about a patient's presumed criminality or presumed non-culpability, in the circumstances leading to an ED visit, may influence clinicians' decisions that guide LEOs' access to patients. Law enforcement presence at the bedside, in turn, may serve to reinforce discriminatory assumptions and to further erode clinicians' trust in patients, and vice versa.

The presence of LEOs in the clinical space, whether warranted or not in the context of public safety and criminal legal proceedings, has potential harms. Therefore, EPs should have a working knowledge of relevant ethical considerations. The first area of ethical consideration requires acknowledgment of the consequences of an overlap between racialized inequities in ED utilization and racialized biases that potentiate negative experiences with law enforcement. Due to structural barriers in access to healthcare writ large, Black and Hispanic patient populations have higher rates of ED utilization than their White counterparts; these same groups are most likely to be impacted by racialized over-policing and violence when interacting with law enforcement and the criminal legal system.[14-17] Studies have found that individuals who have contact with the criminal legal system (being stopped by police, arrested, convicted or incarcerated) are less likely to obtain medical care they thought they needed when compared to those who have never been stopped, arrested, convicted, or incarcerated.[18] Emergency physicians should be familiar with these complex and interdependent realities and the ways in which the presence of law enforcement in EDs is conditioned to, whether directly or indirectly, disproportionately affect Black and Hispanic patients and staff.

A second ethical consideration of importance that emerged in the interpretation of the survey results was that of "dual loyalty," which refers to the simultaneous obligations, express or implied, to a patient and to a third party (typically the state). This concept is highly relevant considering the ethical ambiguities presented by unregulated LEO presence in the ED.[19] The International Dual Loyalty Working Group has issued a set of guiding principles. These include the recommendations that health professionals be able to identify situations where dual-loyalty conflicts threaten human and civil rights, and that health professionals protect patient medical confidentiality from state actors whenever possible. Educational and operational leaders in emergency medicine may consider incorporating these guidelines into their development of training curriculum and institutional policies that dictate the scope of LEO activities in the ED.[20]

Survey respondents looked to LEOs as a source of safety for staff, likely due to concerns of workplace violence (WPV)

experienced by ED staff. Workplace violence—defined as "incidents where staff are abused, threatened or assaulted in circumstances related to their work, including commuting to and from work, involving an explicit or implicit challenge to their safety, well-being or health"—is a global problem, and the ED has repeatedly been demonstrated to be a high-risk clinical space.[21] Workplace violence has been associated with numerous negative impacts on the physical and emotional health of healthcare workers and is detrimental to the retention of healthcare workers and the delivery of quality medical care.[22,23] A systematic review on interventions for WPV prevention in the ED reviewed 15 studies exploring behavioral, organizational, and environmental interventions; none of the interventions involved the addition of law enforcement staff.[24] Instead, recommendations center on preventative measures, such as ensuring adequate staffing and effective triage, improving patient-clinician communication, de-escalation trainings, enforcement of existing policies, and legislation regarding the reporting and filing of charges when appropriate.[25-28] Undoubtedly, ensuring staff safety must be a priority for individual hospitals and for the healthcare workforce at large. However, EPs should be aware that the current body of evidence does suggest that LEO presence prevents WPV. Training EPs on the dual loyalty principle, as well as on the legal, constitutional, and human rights of their patients may allow them to view the presence of LEOs in EDs as an issue distinct from that of staff safety.

As legal scholar Song describes in her recent law review, patients seeking emergency care do not have the same freedoms as individuals on the street to walk away from an encounter due to their medical needs.[5] Song's legal and ethical concerns are echoed by clinicians in a recent qualitative study by Harada et al on the understanding of EPs about LEO activity in the ED.[3] While EPs in this study reported that LEOs could provide helpful information about patients involved in traumatic events, they also reported several ways in which they felt that LEOs interrupted treatment, caused breaches in patient confidentiality, and diminished patient trust in healthcare clinicians and institutions.

Further studies that measure patient perceptions and patient-centered outcomes related to law enforcement presence are important. In a qualitative study by Liebschutz et al, the authors interviewed Black male victims of stabbings and shootings and found institutional mistrust among participants as a result of interactions with police during their medical care.[29] Participants described suspicion of both police and healthcare. Participants perceived healthcare personnel as allowing police interrogation, which made some feel as if they were being treated as the perpetrator rather than a victim. In a study by Jacoby et al, injured Black patients conveyed mixed feelings about the presence of law enforcement in the ED.[30] These patients valued police officers' provision of security at the scene of an injury, assistance in transport to the hospital, and support and information after injury. On the other hand, patients interpreted police questioning as stressful and, at times, disrespectful and in conflict with attention to their emergent clinical needs.

LIMITATIONS

Our findings must be considered within the limitations of our study. First, while the EMPRN network is designed to mirror the demographics of the ACEP membership, our survey respondents may not reflect the demographics of practicing EPs across the country. Second, we are limited in asserting the generalizability of our findings to all ACEP members given a response rate of 18.4%. However, because our survey was administered as part of a series of surveys on multiple topics, it is unlikely that this response rate introduces nonresponse error related to the survey topic itself. Third, our survey design relies on self-report, which is vulnerable to recall bias as well as social desirability bias. Lastly, our survey does not include the observations and attitudes of other key stakeholders, including ED nurses, technicians, hospital administration and, most importantly, patients and families.

CONCLUSION

Despite the study's limitations, we can conclude that while law enforcement activity in the ED is a frequent occurrence, few emergency physicians are aware of institutional policies or guidelines on these interactions. This has the potential to result in ad-hoc decision-making, during which EPs are likely to prioritize staff safety and public safety. Our findings highlight the conflicting interests EPs face when balancing perceived safety with the privacy and autonomy concerns for their patients. Future studies that explore the impacts on patients, clinicians, and the surrounding community of allowing for law enforcement activities in EDs are warranted.

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The Team Is Not Okay: Violence in Emergency Departments Across Disciplines in a Health System

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Introduction: Healthcare workers, particularly those in the emergency department (ED), experience high rates of injuries caused by workplace violence (WPV).

Objective: Our goal was to establish the incidence of WPV among multidisciplinary ED staff within a regional health system and assess its impact on staff victims.

Methods: We conducted a survey study of all multidisciplinary ED staff at 18 Midwestern EDs encompassing a larger health system between November 18–December 31, 2020. We solicited the incidence of verbal abuse and physical assault experienced and witnessed by respondents over the prior six months, as well as its impact on staff.

Results: We included responses from 814 staff (24.5% response rate) for final analysis with 585 (71.9%) indicating some form of violence experienced in the preceding six months. A total of 582 (71.5%) respondents indicated experiencing verbal abuse, and 251 (30.8%) indicated experiencing some form of physical assault. All disciplines experienced some type of verbal abuse and nearly all experienced some type of physical assault. One hundred thirty-five (21.9%) respondents indicated that being the victim of WPV has affected their ability to perform their job, and nearly half (47.6%) indicated it has changed the way they interact with or perceive patients. Additionally, 132 (21.3%) indicated experiencing symptoms of post-traumatic stress, and 18.5% reported they have considered leaving their position due to an incident.

Conclusion: Emergency department staff suffer violence at a high rate, and there is no discipline that is spared. As health systems seek to prioritize staff safety in violence-prone areas such as the ED, it is imperative to recognize that the entire multidisciplinary team is impacted and requires targeted efforts for improvement in safety. [West J Emerg Med. 2023;24(2)169–177.]

INTRODUCTION

Healthcare workers experience high rates of injuries caused by workplace violence (WPV). Within the United States, they are five times as likely to suffer an injury as a result of violence in the workplace than workers overall in all industries.[1] Emergency departments (ED) represent a healthcare setting where violence is commonly experienced.[2-12] Prior studies have sought to establish the incidence of WPV among individual staff groups, such as clinicians[2,3] and nursing staff;[4,13,14] however, researchers seeking to establish the incidence of violence among multidisciplinary ED team members have done so at individual hospital facilities[5,6] or have been limited in ancillary staff surveyed.[8-10] To our knowledge, a comprehensive multidisciplinary incidence of

WPV against ED staff has not been established within a large, diverse health system. Our objective in this study was to establish the incidence of WPV among multidisciplinary ED staff within a regional health system in the Midwestern US and assess its impact on staff victims.

Population Health Research Capsule

What do we already know about this issue?
Healthcare workers, particularly those in the ED, experience high rates of injuries caused by workplace violence (WPV).

What was the research question?
What is the incidence and impact of WPV among multidisciplinary ED staff within a regional health system?

What was the major finding of the study?
ED staff suffer violence at a high rate (71.9%) and no discipline is spared. Nearly half reported changing how they interact with patients, 21.3% reported post-traumatic stress, and 18.5% considered leaving their position.

How does this improve population health?
As health systems seek to prioritize staff safety in violence-prone areas, it is imperative to recognize that the entire multidisciplinary team is impacted.

Methods

Study Design and Setting

This descriptive, cross-sectional study, which took place November 18–December 31, 2020, included 18 Midwestern EDs encompassing a larger regional health system across Minnesota and Wisconsin. Survey sites included EDs in four larger, regional hospitals, four midsize hospitals, and 10 critical access hospitals with individual annual average 2019 ED patient volumes of 43,910, 15,877 and 7,703, respectively.[15]

Security Features of Emergency Department Sites

Eight (44.4%) study sites feature a locked unit within the ED, three (16.7%) use hand-held metal detectors, and six (33.3%) report some degree of weapons screening, often passive screening, while having behavioral health patients change out of street clothes. Seven (38.9%) of the sites indicated 24/7 hospital security staffing, one (5.6%) indicated staffing seven nights a week (6 PM – 6:30 AM), one (5.6%) reported staffing five days a week, seven (38.9%) reported staffing three days a week, and two (11.1%) indicated no scheduled security staffing. Among the 16 sites with security staffing, one (6.3%) had 24/7 security staffing within the ED, two (12.5%) had part-time dedicated ED security staff, and the remainder of sites (13; 81.3%) indicated no dedicated ED security staffing. The site with 24/7 ED security availability also implemented a part-time police officer program (2 PM – 2 AM) with three local law enforcement officers during the study period. Police officers at this site served as a law enforcement service within the hospital and a resource to staff but did not perform a security role within the department.

Selection of Participants

The target population consisted of all multidisciplinary staff who work within the ED, including non-ED staff assigned to other departments that perform services for ED patients. This population included clinicians (attending and resident physicians as well as advanced practice providers), nursing staff and patient care assistants, unit secretaries, ancillary testing service personnel (electrocardiogram, urology [responsible for placing all indwelling urinary catheters at one site), radiology, and phlebotomy)], registration/finance staff, paramedics/emergency medical technicians (EMT) (responsible for providing clinical assistance at some sites), social workers, respiratory therapists, housekeeping staff, and security officers. After institutional review board (IRB) review, the survey was distributed broadly by department and job type to anyone who might work in the ED even occasionally, via email distribution lists to the target population with a cover letter describing the study purpose, directions for participation, and information regarding informed consent.

The survey was sent electronically to 3,397 staff members, although these distribution lists also included some hospital staff not working in the ED, who would not participate as the scope of the questions was limited to ED work. The questionnaire included a statement of informed consent at the beginning, and completion indicated participant consent for inclusion in the study. Three reminder notices were sent through the same method prior to the close of the survey. The IRB reviewed this study and materials and deemed it exempt from approval requirement.

Measurements

We developed an anonymous online survey (Qualtrics LLC, Provo, UT) that included single-choice, multiple-choice. and Likert-scale response questions. This survey was based on and expanded from a previous survey developed and used in McGuire et al.[6] Participants were asked to indicate whether they had experienced any verbal abuse or physical assault in the prior six months (May/June–November/December 2020) while working in the ED. If answering affirmatively, respondents were directed by survey branching logic to indicate what type of abuse/assault they had experienced, who was the offender (patient, visitor, or coworker), and whether they had reported the incident.[16] Participants were also surveyed on verbal abuse and physical assault witnessed against coworkers with similar branching logic.

We used Likert scales to measure participants' perception of safety and estimated frequency of verbal abuse and physical assault. Study participants were also asked a series of questions to assess the impact that WPV has had on them, including whether it has impacted their ability to perform their job, whether they have taken time off from work or considered leaving their position, whether it has changed the way they interact with or perceive patients, or whether they have experienced any signs or symptoms of post-traumatic stress (flashbacks, severe anxiety, emotional numbing, diminished interest in everyday activities, or detachment from others) as a result of an incident of WPV.[17] We collected standard demographic measures. To encourage survey completion, questions were made optional for respondents to complete.

Outcomes

The primary outcome was the incidence of verbal abuse and physical assault experienced and witnessed by multidisciplinary ED staff in a six-month time frame as indicated by survey responses. The secondary outcome was the reported impact of this violence on staff.

Data Analysis

We summarized survey responses with frequency counts and percentages. Subgroup comparisons of survey responses were made using chi-squared tests. We compared the frequency of violence experienced from patients, visitors, and colleagues using relative risk ratios (RR) with 95% confidence intervals.

RESULTS

A total of 833 respondents completed the survey. We excluded the responses of 19 participants who indicated primary employment at two sites not included in the study cohort because those sites were not fully integrated within the health system. Fourteen respondents indicated working primarily in a management position. As these responses came directly from the targeted distribution lists and may have included some patient care responsibilities in addition to their managerial role, they were included among the 814 total responses used for final analysis. Cohort demographics are provided in Table 1.

Table 1. Respondent demographics.[†]

	N (%)
Gender (N = 658)	
Male	172 (26.1%)
Female	483 (73.4%)
Transgender	3 (0.5%)
Race (N = 814)	
White	638 (78.4%)
Non-White	176 (21.6%)
Ethnicity (N = 661)	
Hispanic/Latino	19 (2.9%)
Not Hispanic/Latino	642 (97.1%)
Worked in ED for 6 months (N = 814)	
Yes	728 (89.4%)
Primary role in ED (N = 683)	
Clinicians	109 (16.0%)
Nursing staff	208 (30.5%)
Testing services	119 (17.4%)
Social work	28 (4.1%)
Housekeeping	36 (5.3%)
Paramedic/EMT	12 (1.8%)
Unit secretary	12 (1.8%)
Registration/finance	75 (11.0%)
Security	47 (6.9%)
Management	14 (2.0%)
Respiratory therapy	23 (3.4%)
Employment status (N = 678)	
Full time	364 (53.7%)
Part time	286 (42.4%)
Supplemental[1]	28 (4.1%)
Primary shift (N = 680)	
Day	255 (37.5%)
Evening	80 (11.8%)
Night	104 (15.3%)
Rotating	241 (35.4%)
Years of experience (N = 683)	
0-4 years	190 (27.8%)
5-10 years	194 (28.4%)
11-20 years	178 (26.1%)
21+ years	121 (17.7%)
Primary ED location (N = 673)	
Regional hospital	450 (66.9%)
Midsize hospital	102 (15.2%)
Critical access hospital	121 (18.0%)

[†]Some questions were not fully completed, in which case the number of provided responses to each question are provided. Percentages are relative to the total number of available responses.

[1]Supplemental staff are trained and credentialed ED staff brought in "as needed" for coverage without specific time commitments within the department.
ED, emergency department; *EMT,* emergency medical technicians.

Incidence of Workplace Violence

Overall, 585 (71.9%) respondents indicated experiencing some form of violence in the preceding six months, and 545 (67.0%) indicated witnessing a form of violence directed against a coworker. Further, 582 respondents (71.5%)

indicated experiencing verbal abuse, and 537 (66.0%) indicating observing verbal abuse directed against a coworker (Table 2). Two hundred fifty-one (30.8%) respondents indicated experiencing some form of physical assault in the preceding six months, and 286 (35.1%) indicated witnessing a form of physical assault directed against a coworker.

Table 2. Incidence of verbal abuse and physical assault over the prior six months.†

	Personal experience N (%)	Witnessed against coworkers N(%)
Verbal abuse	582 (71.5%)	537 (66.0%)
Threatening tone of voice	N = 763	N = 737
Any source	567 (74.3%)	522 (70.8%)
From patient	510 (89.9%)	488 (93.5%)
From visitor	202 (35.6%)	148 (28.4%)
From coworker	50 (8.8%)	35 (6.7%)
Reported incident	96 (16.9%)	80 (15.3%)
Abusive language	N = 758	N = 733
Any source	538 (71.0%)	494 (67.4%)
From patient	501 (93.1%)	470 (95.1%)
From visitor	168 (31.2%)	134 (27.1%)
From coworker	36 (6.7%)	23 (4.7%)
Reported incident	103 (19.1%)	77 (15.6%)
Racial harassment	N = 741	N = 712
Any source	112 (15.1%)	166 (23.3%)
From patient	96 (85.7%)	159 (95.8%)
From visitor	25 (22.3%)	30 (18.1%)
From coworker	7 (6.3%)	8 (4.8%)
Reported incident	23 (20.5%)	30 (18.1%)
Gender harassment	N = 741	N = 712
Any source	136 (18.4%)	179 (25.1%)
From patient	124 (91.2%)	171 (95.5%)
From visitor	31 (22.8%)	38 (21.2%)
From coworker	8 (5.9%)	6 (3.4%)
Reported incident	18 (13.2%)	30 (16.8%)
Sexual harassment	N = 740	N = 708
Any source	138 (18.6%)	138 (19.5%)
From patient	121 (87.7%)	130 (94.2%)
From visitor	17 (12.3%)	23 (16.7%)
From coworker	11 (8.0%)	6 (4.3%)
Reported incident	24 (17.4%)	30 (21.7%)
Threats of violence	N = 744	N = 723
Any source	232 (31.2%)	255 (35.3%)
From patient	222 (95.7%)	251 (98.4%)
From visitor	40 (17.2%)	43 (16.9%)
From coworker	2 (0.9%)	1 (0.4%)
Reported incident	65 (28.0%)	58 (22.7%)
Physical assault	251 (30.8%)	286 (35.1%)
Assault with weapons	N = 758	N = 661
Any source	17 (2.2%)	51 (7.7%)
From patient	17 (100%)	51 (100%)
From visitor	1 (5.9%)	8 (15.7%)
From coworker	0 (0%)	0 (0%)
Reported incident	8 (47.1%)	20 (39.2%)
Assault with bodily fluids	N = 756	N = 655
Any source	114 (15.1%)	186 (28.4%)
From patient	113 (99.1%)	186 (100%)
From visitor	3 (2.6%)	13 (7.0%)
From coworker	0 (0%)	0 (0%)
Reported incident	43 (37.7%)	49 (26.3%)
Physical assault (punching, biting, scratching…)	N = 757	N = 660
Any source	217 (28.9%)	266 (40.3%)
From patient	217 (100%)	265 (99.6%)
From visitor	0 (0%)	15 (5.6%)
From coworker	0 (0%)	0 (0%)
Reported incident	95 (43.8%)	79 (29.7%)
Sexual assault	N = 749	N = 654
Any source	7 (0.9%)	13 (1.9%)
From patient	5 (71.4%)	12 (92.3%)
From visitor	0 (0%)	3 (23.1%)
From coworker	2 (28.6%)	0 (0%)
Reported incident	1 (14.3%)	5 (38.5%)

†Participants' answers to each question were optional. For the highest level questions (the presence of physical or verbal abuse), potential participant participation was the entire cohort. For subsequent questions, administered using branching logic, the available participants, for which the percentage possible is shown here, were of those who were administered the questions based on answering in the affirmative to the preceding, higher level question.

Reported frequency of verbal abuse from patients or visitors (N=720) included every day or two (50; 6.9%); every week (110; 15.3%); every month (166; 23.1%); less than once a month (156; 21.7%); and 1-2 times a year (140; 19.4%), while 98 respondents (13.6%) indicated they had never experienced verbal abuse. Reported frequency of physical assault inflicted by patients or visitors (719) included every day or two (1; 0.1%); every week (15; 2.1%); every month

(43; 6.0%); less than once a month (103; 14.3%); and 1-2 times a year (180; 25.0%), with 377 respondents (52.4%) indicating never experiencing physical assault.

When comparing survey site groupings (regional hospitals, midsize hospitals, and critical access hospitals), we found no statistical difference in the overall incidence of violence or incidence of verbal abuse between groups; however, the incidence of physical assault was lower at critical access hospitals (19/121; 15.7%), compared to midsize hospitals (36/102; 35.3%; *P*=.001) and regional hospitals (173/450; 38.4%; *P*< .001).

Nursing staff, clinicians, and security personnel experienced the highest rates of verbal abuse, with over 91% of respondents in these roles reporting some form of verbal abuse (Table 3). Security personnel were more likely to receive personal threats compared to nursing staff or clinicians (68.1% vs 44.2%, *P*=.004). Housekeeping and ED management staff were the least likely to experience verbal abuse, with 42.9% of ED management and 8.3% of housekeeping staff experiencing some form of verbal abuse. These positions experienced significantly less verbal abuse compared to all other positions (18.0% vs 67.7%, *P*<.001). There was no significant difference in harassment personally experienced by respondents based on race (15.2% White respondents vs 14.8% non-White respondents, *P*>.99).

Nursing staff, clinicians, and security personnel also experienced the highest rates of physical assault (Table 3). Security personnel had the highest rate at 78.7%, which was significantly higher than clinicians and nursing staff (78.7% vs 47.3%, *P*<.001) as well as all non-security positions (78.7% vs 25.2%, *P*<.001). Housekeeping staff, social workers, and unit secretaries had the lowest rates of physical assault, with less than 9% of respondents from these job positions indicating any form of physical violence. Staff working ≥6 months in their ED were more likely to have experienced any type of verbal abuse (*P*<.001) and physical violence (*P*<.001) compared to those working <6 months in their ED.

Perpetrators of Violence

Among the 766 respondents who provided data, 545 (71.1%) indicated experiencing verbal abuse from patients, 223 (29.1%) from visitors, and 66 (8.6%) from coworkers. The risk of verbal abuse was nearly 2.5 times greater from patients than visitors (RR 2.44, 95% CI 2.17-2.75; *P*<.001) and over eight times greater from patients than coworkers (RR 8.26, 95% CI 6.53-10.45; *P*<.001). The risk of experiencing verbal abuse from visitors was 3.4 times greater than the risk of verbal abuse from coworkers (RR 3.38, 95% CI 2.62-4.36, *P* <.001).

Physical assault was most commonly perpetrated by patients, with 248 (32.7%) of 759 respondents indicating some form of physical assault from patients. The risk of assault from patients was 62 times greater than the risk of assault from visitors (4/759 respondents, 0.5%; RR 62.0, 95% CI 23.2-165.6; *P*<.001) and over 100 times greater than the risk of assault from coworkers (2/759 respondents, 0.3%; RR 124.0, 95% CI 31.0-496.8; *P*<.001).

Employee Impact of Violence

One-hundred and thirty-five (21.9%) respondents indicated that being the victim of WPV has affected their ability to perform their job (**Table 4**). The time duration of this impact included one shift or day (63, 47.0%); 2-7 days (39, 29.1%); and ≥2 weeks (32, 23.9%), with 17 (12.7%) of these respondents indicating their work was affected for ≥5 months. Nearly half of respondents (293, 47.6%) indicated that being the victim of WPV had changed the way they interact with or perceive patients. One-hundred and thirty-two (21.3%) indicated experiencing symptoms of post-traumatic stress as a result of an incident of WPV, and 127 (18.5%) reported they have considered leaving their position due to an incident.

DISCUSSION

Similar to findings from an earlier survey study specific to a single academic institution (regional hospital),[6] we found a high incidence of verbal abuse (71.5%) and physical assault (30.8%) directed toward multidisciplinary staff in EDs across this Midwest health system. Despite the academic department being the only site to have 24/7 dedicated ED security presence, our prior research demonstrated a higher incidence of verbal abuse (86%) and physical assault (37%) within our academic ED, compared to the larger health system cohort.[8] This finding is contrary to prior literature that documented a higher rate of violent crime against ED staff in smaller hospitals.[12] This is likely not explained by the timing of surveys with the COVID-19 pandemic, as we have also previously shown a positive association between the monthly hospital referral region COVID-19 case rate and rate of violent ED incidents, as well as an increase in violent incidents overall during the pandemic, and this study was sent out during an active wave of the pandemic within our region.[7] It is more likely that this difference can be accounted for by prior methodology, with the exclusion of new hires (those working <6 months in the ED) with our first study and the lack of their exclusion in this study. This is made even more evident when, in this current study, we demonstrated that staff working ≥6 months in their ED were more likely to have experienced violence compared to those working <6 months. This finding is similar to prior literature that has demonstrated more experienced ED staff feel less safe.[9]

Contrary to prior literature that documented a higher rate of violent crime against ED staff in smaller hospitals,[12] we found no statistical difference in the overall incidence of violence or verbal abuse between survey-site groupings (regional hospitals, midsize hospitals, and critical access hospitals); however, we

Table 3. Incidence of violence by job position.

	Verbal Abuse						
Position	Any verbal abuse	Threatening tone	Abusive language	Racial harassment	Gender harassment	Sexual harassment	Personal threats
Clinicians (N = 109)	100 (91.7%)	94 (86.2%)	91 (83.5%)	12 (11.0%)	23 (21.1%)	13 (11.9%)	38 (34.9%)
Nursing (N = 208)	199 (95.7%)	196 (94.2%)	192 (92.3%)	50 (24.0%)	56 (26.9%)	65 (31.3%)	102 (49.0%)
Testing services (N = 119)	64 (53.8%)	59 (49.6%)	50 (42.0%)	7 (5.9%)	15 (12.6%)	10 (8.4%)	9 (7.6%)
Respiratory therapy (N = 23)	17 (73.9%)	15 (65.2%)	15 (65.2%)	1 (4.3%)	1 (4.3%)	1 (4.3%)	3 (13.0%)
Social work (N = 28)	21 (75.0%)	20 (71.4%)	19 (67.9%)	0 (0%)	1 (3.6%)	1 (3.6%)	3 (10.7%)
Housekeeping (N = 36)	3 (8.3%)	0 (0%)	2 (5.6%)	0 (0%)	0 (0%)	0 (0%)	1 (2.8%)
Paramedic/EMT (N = 12)	10 (83.3%)	10 (83.3%)	9 (75.0%)	1 (8.3%)	3 (25.0%)	4 (33.3%)	6 (50.0%)
Unit secretary (N = 12)	8 (66.7%)	8 (66.7%)	8 (66.7%)	1 (8.3%)	1 (8.3%)	2 (16.7%)	2 (16.7%)
Registration/finance (N = 75)	55 (73.3%)	53 (70.7%)	53 (70.7%)	8 (10.7%)	7 (9.3%)	7 (9.3%)	13 (17.3%)
Security (N = 47)	43 (91.5%)	42 (89.4%)	43 (91.5%)	23 (48.9%)	14 (29.8%)	15 (31.9%)	32 (68.1%)
Management (N = 14)	6 (42.9%)	6 (42.9%)	6 (42.9%)	0 (0%)	1 (7.1%)	0 (0%)	3 (21.4%)

	Physical assault				
Position	Any physical assault	Assault-weapons	Assault-fluids	Assault-physical	Assault-sexual
Clinicians (N = 109)	39 (35.8%)	1 (0.9%)	17 (15.6%)	31 (28.4%)	0 (0%)
Nursing (N = 208)	111 (53.4%)	10 (4.8%)	58 (27.9%)	98 (47.1%)	3 (1.4%)
Testing services (N = 119)	23 (19.3%)	0 (0%)	4 (3.4%)	22 (18.5%)	1 (0.8%)
Respiratory therapy (N = 23)	4 (17.4%)	1 (4.3%)	1 (4.3%)	2 (8.7%)	0 (0%)
Social work (N = 28)	2 (7.1%)	0 (0%)	0 (0%)	2 (7.1%)	0 (0%)
Housekeeping (N = 36)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Paramedic/EMT (N = 12)	3 (25.0%)	0 (0%)	2 (16.7%)	3 (25.0%)	0 (0%)
Unit secretary (N = 12)	1 (8.3%)	0 (0%)	1 (8.3%)	1 (8.3%)	0 (0%)
Registration/finance (N = 75)	8 (10.7%)	3 (4.0%)	5 (6.7%)	1 (1.3%)	0 (0%)
Security (N = 47)	37 (78.7%)	2 (4.3%)	18 (38.3%)	37 (78.7%)	0 (0%)
Management (N = 14)	2 (14.3%)	0 (0%)	1 (7.1%)	2 (14.3%)	0 (0%)

EMT, emergency medical technician.

Table 4. Employee impact of violence.†

	N (%)
How safe do you feel in the ED? (N = 805)	
Extremely safe	86 (10.7%)
Very safe	308 (38.3%)
Moderately safe	323 (40.1%)
Slightly safe	72 (8.9%)
Not safe at all	16 (2.0%)
Has being the victim of violence affected your ability to perform your job? (N = 617)	
Yes	135 (21.9%)
How long was your work affected? (N = 134)	
One shift	44 (32.8%)
One day	19 (14.2%)
2-7 days	39 (29.1%)
2-3 weeks	6 (4.5%)
1-4 months	9 (6.7%)
5+ months	17 (12.7%)
Has being the victim of violence changed the way you interact with or perceive patients? (N = 616)	
Yes	293 (47.6%)
Have you experienced any of the following due to an incident: flashbacks, anxiety, emotional numbing, diminished interest, or detachment from others? (N = 618)	
Yes	132 (21.3%)
Have you ever considered leaving your position due to incidents of violence? (N = 685)	
Yes	127 (18.5%)

†Some questions were not fully completed, in which case the number of provided responses to each question are provided. Percentages are relative to the total number of available responses.
ED, emergency department.

did find that smaller, critical access sites had a significantly lower incidence of physical assault during the study period. Future research should attempt to identify the reason(s) for this difference in physical assault between sites.

Alarmingly, all staff disciplines experienced some type of verbal abuse and nearly all, except for housekeeping, experienced physical assault within the study period. Our study demonstrates that certain disciplines fall into different risk categories. High-risk positions for verbal abuse include clinicians, nursing, and security; medium-risk positions include respiratory therapists, social workers, paramedics/EMTs, unit secretaries, and registration/finance clerks; and lower risk positions include ancillary testing services, housekeeping, and management. High-risk positions for physical assault remain the same (clinicians, nursing, and security), whereas medium-risk positions include ancillary testing services, respiratory therapy, management, and paramedics/EMTs. Lower risk positions for physical assault include registration/finance, unit secretaries, housekeeping, and social workers. That said, the level of violence suffered by even the lower risk positions was still significant and staggering, with many of these personnel still reporting abuse in the prior six months. It is imperative that institutions and the general public recognize that all multidisciplinary team members experience WPV, including disciplines that have not historically been targeted for protective strategies or "burnout campaigns."[18] Recognizing that all team members are impacted and that there are differing levels of risk based on discipline can help drive future institutional policies and preventative measures.

It is worth noting that violence in healthcare is not generally related to mental illness (previously reported as a cause of ED violence in only 5.4% of assaults); in fact, the majority of violence is related to chemical health (eg, intoxication, withdrawal, and drug-seeking behaviors) (>70%).[14] Additionally, while we found a significant amount of verbal abuse from family/visitors, it is interesting to note that physical violence was overwhelmingly committed by patients and not visitors. This distinction deserves additional attention and study as this key difference may reveal heretofore unknown prevention strategies as it relates to patients. Further details on patient characteristics or care episode characteristics (eg, length of stay, boarding, medication use, wait times) were not available based on the survey nature of the data. Future study is needed to better determine additional patient/care factors associated with violence.

A small but not insignificant amount of verbal abuse and physical assault was reported to have come from coworkers. We strongly advocate for increased reporting among staff of all violent incidents, verbal abuse, harassment, and microaggressions, regardless of perpetrator or clinical setting, in accordance with the premise that apathy toward low-level events creates an environment conducive to more serious offenses.[11] The need for zero tolerance for violence in healthcare is made even more evident by our findings that 1 in 5 of our cohort felt that being the victim of workplace violence had affected their ability to perform their job and nearly 1 in 2 felt it had changed the way they interacted with or perceived patients. Concerningly, 1 in 5 reported symptoms of post-traumatic stress due to workplace violence. Similar to prior literature, we found that a significant number of staff within our cohort have considered leaving their job as a result of violence.[3,13]

LIMITATIONS

This study has several important limitations. To preserve anonymity of employees, the study was sent to email distribution lists and included some lists with employees who worked in other departments other than the ED (eg, phlebotomy, ECG, and radiology technicians). Thus, it was not possible to determine the actual number of employees from different disciplines who work in their respective EDs, and we could only estimate a response rate for this survey study. We also

recognize the potential for nonresponse bias in that respondents who had not experienced WPV may not have completed the survey. Certainly, we would anticipate that victims of traumatic events may be more or less likely to respond to a survey in which they would be asked to recount details of those events. Additionally, we could not control for a true nonresponse rate due to the use of email distribution lists, where individuals on those lists who did not work in the ED during the study period were instructed not to respond to the survey.

Given that the definition of "verbal abuse" is highly subjective, survey inclusion of "threatening tone of voice" may have contributed to over-reporting of verbal abuse in general by respondents. The study was also subject to recall and reporting bias in terms of recalling violence experienced or reporting incidents over a six-month period. Although this was a multicenter study, it was localized to a specific health system and region within the United States; therefore, some aspects may not be generalizable to all institutions or geographic regions. However, the findings of significant incidence of verbal abuse and physical assault experienced by ED staff are not dissimilar to other published studies. Our findings that abuse and violence affect previously unstudied populations, including ancillary services and support staff, is important and not likely related to local factors.

CONCLUSION

We found a high incidence of verbal abuse (71.5%) and physical assault (30.8%) directed toward multidisciplinary staff in EDs across our Midwest health system. All staff disciplines experienced some type of verbal abuse, and nearly all experienced physical assault within the study period. Alarmingly, 1 in 5 of our cohort felt that being the victim of workplace violence affected their ability to perform their job and nearly 1 in 2 agreed it had changed the way they interact with patients; 1 in 5 reported symptoms of post-traumatic stress, and nearly 1 in 5 reported that they had considered leaving their job as a result of a violent incident.

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Operations Factors Associated with Emergency Department Length of Stay: Analysis of a National Operations Database

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Introduction: Prolonged emergency department (ED) length of stay (LOS) has been shown to adversely affect patient care. We sought to determine factors associated with ED LOS via analysis of a large, national, ED operations database.

Methods: We performed retrospective, multivariable, linear regression modeling using the 2019 Emergency Department Benchmarking Alliance survey results to identify associated factors of ED LOS for admitted and discharged patients.

Results: A total of 1,052 general and adult-only EDs responded to the survey. Median annual volume was 40,946. The median admit and discharge LOS were 289 minutes and 147 minutes, respectively. R-squared values for the admit and discharge models were 0.63 and 0.56 with out-of-sample R-squared values of 0.54 and 0.59, respectively. Both admit and discharge LOS were associated with academic designation, trauma level designation, annual volume, proportion of ED arrivals occurring via emergency medical services, median boarding, and use of a fast track. Additionally, admit LOS was associated with transfer-out percentage, and discharge LOS was associated with percentage of high Current Procedural Terminology, percentage of patients <18 years old, use of radiographs and computed tomography, and use of an intake physician.

Conclusion: Models derived from a large, nationally representative cohort identified diverse associated factors of ED length of stay, several of which were not previously reported. Dominant within the LOS modeling were patient population characteristics and other factors extrinsic to ED operations, including boarding of admitted patients, which was associated with both admitted and discharged LOS. The results of the modeling have significant implications for ED process improvement and appropriate benchmarking. [West J Emerg Med. 2023;24(2)178–184.]

INTRODUCTION

Emergency department (ED) length of stay (LOS) impacts a number of key patient-centered outcomes. Specifically, prolonged ED LOS adversely affects mortality,[1-3] left without being seen rates,[1,4] overall hospital LOS,[1,5,6] and patient satisfaction.[7,8] A small number of investigations describing causes for prolonged ED LOS exist. However, the body of literature is somewhat limited by the methodological approaches of the individual investigations, which generally have been characterized by small sample sizes, single-site studies or before-and-after study designs, which did not measure for all potential confounding factors thought or known to affect ED LOS. Nonetheless, the available literature in aggregate does suggest that the cause of prolonged ED LOS is multifactorial with potential contributing factors including patient population characteristics[9-12] (eg, annual patient encounters, proportion of pediatric patients), intrinsic ED operations characteristics[13-15] (eg, utilization of a low-

acuity patient fast track), and extrinsic flow constraints[10] (eg, hospital occupancy, elective surgical admissions). The relative paucity of investigations in this area of study coupled with the methodological limitations has precluded generalizability of conclusions; so there remains opportunity to improve our overall understanding of the constellation of factors contributing to ED LOS.

Despite demonstration of the deleterious effects of prolonged ED LOS and the identification of some potential causes, there has been little progress in improving ED LOS nationally over the past decades.[16,17] Our study builds upon prior research by considering a diverse array of operational variables from greater than 1,000 EDs across the United States, including patient-population factors and intrinsic and extrinsic operational factors, allowing for a more robust and generalizable understanding of ED LOS-associated factors. Better identification of associated factor variables stands to inform efforts to improve ED patient flow and mitigate harms associated with prolonged LOS.

The purpose of our investigation was to determine factors associated with ED LOS using a large, national, ED operations database.

Population Health Research Capsule

What do we already know about this issue?
Prolonged emergency department (ED) length of stay (LOS) has been shown to adversely affect patient care and staff satisfaction.

What was the research question?
Based on a national ED operations database, what factors are most associated with admit and discharge ED LOS?

What was the major finding of the study?
Median boarding time was a dominant variable for both admit (0.9, P<0.001) and discharge (0.18, P<0.001) LOS.

How does this improve population health?
These models may better guide managers when implementing initiatives to improve admit and discharge ED length of stay.

METHODS

We used the 2019 Emergency Department Benchmarking Alliance (EDBA) survey results for general and adult-only EDs. The EDBA survey responses from pediatric EDs, specialty EDs (smaller EDs at specialty hospitals focused on specific specialties such as orthopedics or obstetrics and gynecology), and free-standing EDs were excluded from our investigation as they were not necessarily representative of the operational experiences of most EDs and were limited in number. The University of Massachusetts Medical School Institutional Review Board approved the investigation as exempt.

The EDBA is a not-for-profit, national consortium created to support and improve clinical operations of EDs. Among other efforts, the EDBA administers an annual ED operations survey to its member and past-member institutions. Within the survey instrument are several operations-related questions. Survey participation is voluntary. However, receiving de-identified results and aggregate analyses of the survey is a benefit afforded to participants and a primary motivator for membership in the consortium overall. The EDBA membership and survey development details are available in previous publications[18] and at the EDBA website.[16] We analyzed the EDBA survey administered and reported in 2019, which reflected reported ED data from January 1–December 31, 2018. A list of survey-related variable definitions can be found in the EDBA dictionary.[19]

We evaluated two primary outcomes: 1) ED LOS for patients admitted to an inpatient setting from the ED; and 2) ED LOS for patients discharged from the ED. While there may have been overlap in the potential factors affecting LOS for these two populations, the factors were anticipated to have affected the two groups differently; therefore, we analyzed the two outcomes separately. Separately considering these two populations was consistent with oversight entities such as the Centers for Medicare and Medicaid Services, which report ED LOS data for both patient populations.[20]

We reviewed the 2019 EDBA survey instrument and identified candidate variables with face validity for potential associated factors of ED LOS. The following continuous and categorical variables were identified as candidates to be included in our subsequent analysis: academic (designation); trauma level (designation); ED volume (ie, annual patient encounters); percentage of high Current Procedural Terminology coding (CPT); percentage of patients under 18; admit percentage; hospital admit percentage from the ED (ie, percentage of all hospital admissions originating from the ED); transfer-out percentage (ie, percentage of ED patients transferred to another hospital); proportion of ED arrivals occurring via emergency medical services (EMS); median boarding (time); use of an intake or triage physician; use of an intake or triage advanced practice provider; use of a fast track; and the number per 100 patients for diagnostic studies that included electrocardiograms, radiographs, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasounds. Based on prior reports, we perceived a potential for multicollinearity for trauma level designation with annual volume and academic status.[21]

However, we also anticipated that the referral patterns associated with being a Level I trauma center were likely to

be an associated factor of ED flow independent of academic designation or annual volume.[22,23] Therefore, we included Level I trauma center vs other as a candidate variable in modeling. Percentage of hospital admissions originating from the ED and MRIs per 100 patients were not reported by 51.5% and 44.6% of the institutions responding to the survey, respectively. We excluded these two candidate variables from final analysis for two reasons. First, their missingness percentages were high outliers compared to the other variables, which ranged from 0.6 to 26.7% with a median of 11.3% (Supplemental Table 1). In addition, the missing data was primarily from rural, non-academic, small-volume EDs, which would likely have led to significant bias if we imputed their data using dissimilar sites for their new values. In terms of variable values, there were no significant outliers identified for all included variables.

Subsequently, we created two separate multivariable, linear regression models predicting ED LOS for admitted patients and ED LOS for discharged patients. A random 70-30 split was used to construct training and validation sets. We applied a nonparametric missing value imputation algorithm using random forest, missForest,[24] across the 16 independent variables with missing values within each set to allow for a more robust imputation. The algorithm assumed pairwise independence between observations but notably did not assume data being missing at random. Median and mean values did not appreciably differ between the original and imputed dataset (Supplemental Table 2). Of note, we chose missForest for its ability to impute across mixed-type data and the lack of studies clearly identifying another imputation technique as superior.

Variance inflation factors ranged from 1 to 3, indicating non-significant levels of multicollinearity[25] (Table 1). With regard to our assumptions related to trauma level designation, the variance inflation factor was 1.92 for the admit model and 1.70 for the discharge model.

We conducted model validation by computing adjusted R-squared and out-of-sample R-squared values and used an alpha value of 0.05. All analyses were performed using R version 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria).

Table 1. Variance inflation factors for each variable across the admit and discharge models.

Variable	VIF for admit model variables	VIF for discharge model variables
Academic designation (vs not)	1.97	1.89
Trauma level 1 designation (vs not)	1.92	1.70
Annual volume (per patient)	2.23	2.32
Percentage of high Current Procedural Terminology coding	1.31	1.39
Percentage of patients <18 years old	1.63	1.64
Admit percentage	2.73	2.93
Transfer-out percentage	1.64	1.61
Emergency medical services arrival percentage	2.28	2.40
Median boarding time (in minutes)	1.43	1.45
Electrocardiograms per 100 patients	2.08	2.09
Radiographs per 100 patients	2.22	2.42
Computed tomography per 100 patients	2.37	2.51
Ultrasounds per 100 patients	1.33	1.53
Use of an intake physician (vs none)	1.42	1.46
Use of an intake advanced practice provider (vs none)	1.30	1.29
Use of a fast track (vs none)	1.54	1.55

VIF, variance inflation factor.

RESULTS

A total of 1,389 total EDs were surveyed by the EDBA with 1,335 responding (96% response rate). Of the responding EDs, we excluded 283 pediatric-only, specialty, and freestanding EDs, resulting in 1,052 EDs included in the analysis. The demographics for the included ED sites are reported in Table 2. The median annual patient volume was 40,946. The median admit and discharge LOS were 289 minutes (interquartile range [IQR] 122-184 minutes) and 147 minutes (IQR 237-359 minutes), respectively. Academic designation, trauma Level I designation, annual volume, transfer-out percentage, EMS arrival percentage, median boarding, and use of a fast track were significant associated factors of admit LOS (Supplemental Table 3).

Significant associated factors of discharge LOS were academic designation, trauma Level I designation, annual volume, high CPT percentage, percentage of patients <18 years old, EMS arrival percentage, median boarding, radiographs per 100 patients, CT per 100 patients, use of an intake or triage physician, and use of a fast track (Supplemental Table 4).

DISCUSSION

Our regression modeling of the results of the 2019 EDBA survey, which included approximately one quarter of all EDs in the US, identified multiple factors associated with ED LOS that have not been previously reported. In addition, our results corroborated findings reported in prior investigations with more limited study populations. Overall, our results confirmed that factors associated with ED LOS are diverse and span three general categories: intrinsic ED operational factors; extrinsic operational factors; and the characteristics of the patient population served. Moreover, our investigation revealed that patient population characteristics and operational factors extrinsic to the ED dominated the associated factors associated with LOS for both admitted and discharged

Table 2. Demographics of emergency departments included in dataset.

	Total (N)	Percent of total
Community type		
Suburban	464	44.1%
Urban	326	31.0%
Rural	260	24.7%
No response	2	0.2%
Academic designation		
Yes	248	23.6%
No	797	75.8%
No response	7	0.7%
Trauma level designation		
Level I	134	12.7%
Level II	132	12.5%
Level III	133	12.6%
Level IV	95	9.0%
Not a trauma center	552	52.5%
No response	6	0.6%
Annual encounters		
More than 120,000	12	1.1%
100,000-120,000	23	2.2%
80,000-100,000	70	6.7%
60,000-80,000	167	15.9%
40,000-60,000	263	25.0%
20,000-40,000	321	30.5%
Less than 20,000	190	18.1%
No response	6	0.6%

patients. The associated factors for admit and discharge LOS overlapped for the most part, highlighting that LOS for the two groups likely was influenced by common factors, although there were some differences worthy of consideration.

In general, the factors associated with admit LOS appeared to be dominated by characteristics related to the patient population served. Academic and trauma level designation have been reported previously as likely surrogates for acuity and complexity of patient populations.[18] Furthermore, a high proportion of arrivals by EMS also has been associated with higher complexity of patient populations and higher admission rates in prior studies.[18,26] These factors were all associated with increased admit LOS in our study. Additionally, annual patient volume was associated with longer admit LOS in our investigation. While larger centers likely care for more complex patient populations as they often serve as referral centers for specialty care, patient volume remained an independent associated factor of LOS.

Other factors associated with admit LOS included boarding time, transfer-out percentage, and presence of a fast track. Assuming that the transfer-out percentage primarily reflected lack of availability of specialized resources within the greater hospital, only one factor associated with admit LOS was intrinsic to ED operations: presence of a fast track. It is interesting to note that an operational strategy intended to focus on low-acuity patients (presumably more likely to be discharged) was associated with reduced LOS for admitted patients, likely confirming that the efficiencies from split flow described in a limited set of academic EDs hold true more broadly.[14] While the EDBA survey data did not allow for causal investigation, this finding highlighted that ED operational processes are complex and intertwined. In aggregate, our study results revealed that admit LOS is predominantly associated with factors outside ED operations.

Factors associated with discharge LOS included all the associated factors of admit LOS with the exception of transfer-out percentage. Given that the transfer-out percentage likely reflected available hospital resources, this association with admit LOS but not discharge LOS has face validity given that most discharged patients are less likely to require subspecialty expertise. In addition to the associated factors discussed above, for admit LOS, discharge LOS was associated with several additional variables. Greater proportion of higher CPT coding was associated with increased discharge LOS. Although it may be influenced by local documentation and coding/billing practices, the CPT coding system is designed to represent patient acuity and complexity. Patient age <18 also was a significant associated factor of discharge LOS, with a larger percentage of pediatric patients having been associated with shorter discharge LOS. This appears to be consistent with prior reports that pediatric ED patients tend to have lower acuity and complexity compared to their adult counterparts.[27] It remains unclear why proportion of pediatric patients and higher CPT codes would be associated with discharge LOS but not admit LOS.

Also associated with discharge LOS, but not admit LOS, were utilization of plain film radiography and CT. It is intuitive that performing more CTs and radiographs could prolong LOS for all patients. However, it is interesting that imaging utilization was not associated with admit LOS. Intuitively, admitted patients would have been characterized by higher acuity and complexity than discharged patients and likely would have required these resources to a greater degree. Two possible explanations may be that 1) for admitted patients, the additional time for imaging did not affect their overall LOS because the time waiting for imaging ran in parallel with other factors influencing LOS, or 2) other factors such as boarding became so dominant for admitted patients that imaging no longer was significant within the multivariable analysis. We postulate that the imaging utilization variables likely represent both a surrogate for patient population, such as acuity, and internal ED operational factors, such as local practices and practice cultures related to performing more or fewer imaging studies.

The remaining associated factor of discharge LOS was the presence of an intake or triage physician. (The EDBA survey did not differentiate between those two different models and terms.) Interestingly, physician intake was associated with longer discharge LOS. We postulate that this seemingly paradoxical finding did not imply causality but rather implied that this operational strategy was being implemented predominantly in EDs already challenged in patient flow due to other factors. Whether the presence of a physician in triage is an effective flow intervention was not possible to determine from our study.

Our finding that boarding was associated with both admit and discharge LOS warrants further reflection. De facto, boarding is a component of admit LOS; so its association with admit LOS was not unexpected. However, the finding of boarding being associated with discharge LOS has broader implications. Emergency departmemt operations leaders anecdotally have reported being held accountable for ED LOS for discharged patients, rather than all or admitted patients, under the premise that the discharged patient LOS is entirely under ED operational control. While our study was not designed to determine causality, our findings appeared to refute this notion, as boarding (among other non-intrinsic ED factors) was associated with prolonged LOS for discharged patients. Perhaps more importantly, boarding differs from the other extrinsic factors uncovered in our investigation in that it is a relatively manageable contributor to ED LOS.[10,28]

In general, our results are consistent with prior reports related to factors associated with ED LOS. Prior studies also identified ED volume,[9,10] EMS arrival percentage,[9] boarding or crowding levels,[9,10] and academic designation[18] as associated factors of ED LOS. One prior study showed that dedicated pediatric EDs were characterized by shorter LOS for discharged patients when compared to adult EDs.[29] Our results related to the proportion of pediatric patients may be consistent with this result; however, the prior investigation differed in its methodology in that it compared dedicated pediatric EDs to general and adult-only EDs. Therefore, the prior study results may have reflected operational processes rather than the patient population itself. Our results also are consistent with prior reports showing flow improvements due to implementation of a fast track.[13,30] Finally, with regard to our findings that admission percentage was not associated with LOS, a prior investigation did report that ED LOS increased on days that the admit percentage was higher from the ED. The two studies differed significantly in methodology, and it appears that the prior study's results more likely reflected flow constraints related to daily variability, which was not measured in the EDBA survey tool. Therefore, it appears that the two investigations' findings are not necessarily contradictory.

Our findings have significant implications for ED flow improvement efforts. In addition to highlighting specific factors associated with ED LOS across a large proportion of the EDs in the US, our study results show clearly that patient population-related factors dominate the list of variables associated with ED LOS. This observation underscores prior reports that cite the importance of appropriate benchmarking of ED operational outcomes for the purposes of ED process improvement guidance.[18,21] Comparing EDs with significantly different characteristics such as patient volumes, trauma level designation or academic vs non-academic EDs for the purposes of guiding operational management efforts may be ill advised in light of the results of our investigation that provide additional evidence that they are not likely to be relevant comparators.

In addition, our results highlight that the constellation of factors associated with admit LOS and discharge LOS overlap more than they differ, but they appeared to differ predominantly in factors that reflect intrinsic ED operational factors. This implies that when developing internal ED initiatives aimed at improving LOS, ED leadership should consider admitted and discharged patient populations separately when designing interventions and tracking metrics. Finally, our results provide additional evidence that reducing or eliminating boarding stands to be a pivotal ED flow strategy to reduce LOS for both admitted and discharged patients.

This was a retrospective, survey-based investigation. Overall, the survey exhibited a high response rate at 96%; however, there were more limited response rates for some individual survey questions. We employed validated methodology to impute missing data; however, missingness remains a potential limitation of our investigation. In particular, we excluded two candidate variables due to excessive missingness: percentage of hospital admissions originating from the ED; and MRIs per 100 patients. It is possible these factors may have been associated with ED LOS but remained unmeasured in our study design. The survey instrument was administered to EDBA members and past member EDs, rather than a random sampling of US EDs, which could have introduced sampling bias.

While reports of the total number of EDs and hospitals in the US in 2018 vary,[31,32] it appears that the 1,389 EDs surveyed represented approximately a quarter of all US EDs at the time (likely even greater when excluding pediatric, specialty and free-standing EDs as was done in our methodology). While the lack of randomization must be considered when interpreting the results, the study population did represent a sizable proportion of general EDs. The EDBA survey instrument had been developed and refined over 25 years by experts in ED operations; nonetheless, the survey was not necessarily designed as a tool to include specifically all potential factors associated with ED LOS. Therefore, some factors may have been unmeasured by the survey instrument. Finally, responses to the survey were reported by participants as an annual aggregate value; so temporal factors potentially associated with ED LOS, such as daily or seasonal variability, could not be accounted for in our investigation. Data was

reported at the level of the ED, rather than at the patient level; so caution is warranted in making inferences or predictions about an individual patient's LOS, as our focus was on the overall performance of the ED as a whole.

LIMITATIONS

As with any survey-based investigation, data integrity may have been limited by response bias, although the EDBA survey encompassed about a quarter of all EDs in the nation and remains the largest national ED metrics database. In addition, as with any survey-based investigation, we could not be certain of accurate and complete responses from survey participants. However, the EDBA survey instrument incorporated widely accepted and well-defined data definitions,[19] lessening concerns related to accuracy.

Our analytical methodology also had limitations. Candidate variables were selected based on expert and author consensus of mechanistic plausibility. The ratio of potential associated factors to outcomes dictated that not all variables available from the EDBA be included in our models, and it is possible that excluded variables may have also been associated with ED LOS. In addition, our approach assumed linear relationships, and there remains a possibility of non-linear relationships among associated factors and with the outcomes. Because our goal was to describe factors associated with LOS at the level of the ED (to inform systems intervention opportunities, as opposed to predicting LOS for any given individual patient), we prioritized creating human-interpretable and more parsimonious models.

Constructing non-linear or "black box" machine-learning models would have been computationally feasible but impractical for our objective, as their interpretation is far less intuitive. Instead, we accepted the limitations of linearity assumptions to obtain the benefit of quantitative and intervenable model outputs (eg, a finding that "on average, having a fast track is associated with a 19-minute reduction in admitted patient LOS" is much more actionable than "presence of a fast track contributes to 6% of the variance in LOS"). Since our analysis occurred at the level of the ED, the other assumptions of linear regression were less limiting and easily verifiable, such as normality and homoscedasticity of the residuals.

We also noted a tendency for smaller, rural, non-trauma centers to contribute relatively more to data missingness. While the missing data was imputed with robust techniques, it remains unclear how this tendency may have affected the models. Lastly, our selected imputation algorithm, missForest, assumed pairwise independence between sites. Intuitively, we believed this to be a reasonable assumption for the majority of EDBA member institutions. However, some EDs in the database were part of multi-ED health systems, opening the possibility of them not being completely independent from other EDs within their health system.

CONCLUSION

Models derived from a large, nationally representative cohort identified diverse associated factors of ED length of stay. Factors extrinsic to ED operations and patient population-associated factors were dominant within the modeling for both admit and discharge LOS. Notably, boarding of admitted patients was associated with not only admit LOS but also LOS for discharged patients, a subset of ED patients not directly subject to boarding. While the constellation of factors associated with admit LOS and discharge LOS predominantly overlapped, discharge LOS exhibited association with more factors intrinsic to ED operations than admit LOS. The results of our investigation have significant implications for appropriate benchmarking and ED process improvement efforts.

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Impact of Emergency Department Crowding on Discharged Patient Experience

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Introduction: While emergency department (ED) crowding has deleterious effects on patient care outcomes and operational efficiency, impacts on the experience for patients discharged from the ED are unknown. We aimed to study how patient-reported experience is affected by ED crowding to characterize which factors most impact discharged patient experience.

Methods: This institutional review board-exempt, retrospective, cohort study included all discharged adult ED patients July 1, 2020–June 30, 2021 with at least some response data to the the National Research Corporation Health survey, sent to most patients discharged from our large, academic medical center ED. Our query yielded 9,401 unique encounters for 9,221 patients. Based on responses to the summary question of whether the patient was likely to recommend our ED, patients were categorized as "detractors" (scores 0-6) or "non-detractors" (scores 7-10). We assessed the relationship between census and patient experience by 1) computing percentage of detractors within each care area and assessing for differences in census and boarder burden between detractors and non-detractors, and 2) multivariable logistic regression assessing the relationship between likelihood of being a detractor in terms of the ED census and the patient's last ED care area. A second logistic regression controlled for additional patient- and encounter-specific covariates.

Results: Survey response rate was 24.8%. Overall, 13.9% of responders were detractors. There was a significant difference in the average overall ED census for detractors (average 3.70 more patients physically present at the time of arrival, 95% CI 2.33- 5.07). In unadjusted multivariable analyses, three lower acuity ED care areas showed statistically significant differences of detractor likelihood with changes in patient census. The overall area under the curve (AUC) for the unadjusted model was 0.594 (CI 0.577-0.610). The adjusted model had higher AUC (0.673, CI 0.657- 0.690]; P<0.001), with the same three care areas having significant differences in detractor likelihood based on patient census changes. Length of stay (OR 1.71, CI 1.50-1.95), leaving against medical advice/without being seen (OR 5.15, CI 3.84-6.89), and the number of ED care areas a patient visited (OR 1.16, CI 1.01-1.33) was associated with an increase in detractor likelihood.

Conclusion: Patients arriving to a crowded ED and ultimately discharged are more likely to have negative patient experience. Future studies should characterize which variables most impact patient experience of discharged ED patients. [West J Emerg Med. 2023;23(2)185–192.]

INTRODUCTION

Emergency department (ED) crowding continues to be a major challenge in the United States, with important ramifications for patient experience, care quality, and staff experience.[1–9] Crowding has been shown to have deleterious effects on patient care outcomes and operational efficiency.[4,6,8–17] There have been numerous efforts to mitigate ED crowding such as leveraging alternative pathways to avoid hospital admissions, creation of full-capacity protocols to increase inpatient availability of beds, opening of nearby urgent care centers to offload low-acuity volume, and protocols triggering reductions in outside hospital transfers, direct admissions, and elective procedures.[18–28]

While ED crowding has multiple negative operational impacts, the impact on patient experience for ED patients who are ultimately discharged has not been well studied. While long waits and throughput times have been shown to negatively impact experience, the aspects of crowding that most directly impact the experience of discharged ED patients are poorly understood. Several methods for modeling ED crowding have been previously used including index functions taking into account multiple variables,[11,14,29–31] and simple measures such as the ED occupancy rate,[32] boarder burden in the ED,[8] or the number of concurrent ED arrivals, but none have been shown to impact patient experience.[16,33]

A boarding inpatient in the ED ("boarder") is frequently defined as a patient who remains in the ED more than two hours after an inpatient bed request has been placed.[8] Boarding inpatients occupy space and use scarce resources including nursing and clinician bandwidth that would otherwise be used for evaluation of new ED patients. A prior study from our ED found that increased inpatient boarders resulted in an increased length of stay (LOS) for patients who were discharged from the ED, demonstrating a negative impact of boarding on even low-acuity patients.[15]

It is not known whether the operational impacts of crowding result in a worsened patient experience for patients discharged from the ED. We aimed to study how patient-reported experience is affected by ED crowding as measured by the ED census and boarder burden to better characterize which factors most impact discharged patient experience. We hypothesized that worsened ED crowding negatively impacts patient experience for patients discharged from the ED.

Population Health Research Capsule

What do we already know about this issue?
Emergency department (ED) crowding has been shown to negatively impact patient care outcomes and operational efficiency for admitted patients.

What was the research question?
We sought to establish whether crowding results in a worsened experience for patients discharged from the ED.

What was the major finding of the study?
Discharged patients are more likely to be identified as detractors if crowding is worse, with an average greater census at the time of their arrival by 3.70 patients (95% CI 2.33-5.07).

How does this improve population health?
Characterizing how ED crowding impacts discharged patient experience is vital to ensure that operational interventions are impactful in improving patient experience.

METHODS

This study was evaluated by our Institutional Human Research Committee and deemed exempt from institutional review board review.

Setting

This study was conducted at a large academic medical center which is a Level I adult and pediatric trauma center, STEMI-receiving center, and stroke center with approximately 110,000 annual ED visits and 1,019 licensed operational beds. Patients in our ED are triaged by acuity into several care areas (**Table 1**).

Data Collection

Most patients discharged from our ED are subsequently sent an electronic survey to assess their patient experience, which is produced, managed, and administered by the third-party organization National Research Corporation (NRC) Health (Lincoln, NE). The survey is sent to all adult patients within three days of their encounter, unless they meet the following exclusion criteria: surveyed for another encounter within the prior three days or the same department or clinician within the prior six months, previously requested to be excluded from a NRC Health survey, confidential patients (including well known individuals or prisoners), or absent contact information.

The NRC Health survey is administered in Arabic, Chinese (Mandarin), Russian, Portuguese, Haitian Creole, Spanish, Khmer, and English according to the patient's listed preferred language in the electronic health record (EHR). If a language listed is not one of those eight languages, then the survey is administered in English. The surveys are administered by email or interactive voice response (IVR) by phone with the exception of Arabic, which is only administered by IVR. Patients must complete the survey within 15 days of receipt.

This survey includes both quantitative data and qualitative comments. Quantitative data is summarized by a variable called the "net promotor score," which is generated from

Table 1. Description of emergency department care areas.

Care area	Brief description
A	Care area for rapid clinician assessment and intervention for patients not requiring higher acuity resources.
B	Care area for continuation of care for patients initially evaluated in Care Area A who are able to sit in this internal waiting space while awaiting testing results and/or consultation. There are a limited number of curtained bed spaces that can be used to care for non-ambulatory patients or boarding inpatients.
C	Care area for patients with a single-system complaint and without need for continuous monitoring.
D	Care area for low-acuity, ambulatory patients with single-system complaints that do not require monitoring. Primary focuses include stable orthopedic evaluations and minor procedures such as laceration repairs and abscess drainages.
E	Care area for Intermediate acuity patients with cardiopulmonary monitoring capabilities. Patients are not hemodynamically unstable and do not require immediate resuscitation capabilities.
F	Care area for major resuscitation of the highest acuity patients.
G	Care area for patients under the age of 22 who are behaviorally appropriate and do not require the resuscitation capabilities of Care Area F.
H	Emergency department observation unit designed for the continuation of care for patients with an expected length of stay less than 48 hours.

the patient's response to the summary question of whether they are likely to recommend our ED on a scale of 0-10. Scores of 0-6 are categorized as "detractors," scores of 7-8 are "passive," and scores of 9-10 are "promotors." Among patients with at least some survey response data, we defined the responses as binary for "detractors" (ie, scores of 0-6) and "non-detractors." Non-detractors also included non-respondents for the specific recommendation question.

We queried NRC Health survey data to find all ED encounters with available NRC data from July 1, 2020 – June 30, 2021 and for which both a) the patient was at least 18 years old at the time of the ED encounter, and b) the patient was discharged directly from the ED without being admitted as an inpatient (ie, the patient was not admitted to the hospital; transferred from the ED to a procedural area; admitted as an inpatient while in the ED but directly discharged home from the ED, or transferred to another acute care hospital), yielding a total of 9,401 unique encounters for 9,221 patients (**Figure 1**). Using encounter-specific identifiers, we linked each survey response to the patient's EHR (using an internal data warehouse) to obtain pertinent patient demographics, encounter-specific data such as ED LOS, and operational variables at the time of the patient's arrival to their final care location in the ED, including ED census and the number of ED boarders. The ED census and ED boarder burden were measured within the specific location that was the patient's last care area prior to discharge. Boarders were defined as inpatients with a bed request in place for greater than two hours who remained in the ED. These operational metrics were computed based on the census of all patients in the ED.

Statistical Analysis

To assess the relationship between census and patient experience, we conducted descriptive and predictive statistical analyses. For the descriptive analysis, we computed the percentage of detractors among the survey respondents as well as summary data on the associated ED census and ED boarder census at the time of each patient's arrival to their final care area (including differences between detractors and non-detractors). We also performed a multivariable logistic regression analysis to assess the relationship between a patient's likelihood of being a detractor (as an outcome) in terms of the ED census and the patient's care area in the ED. In addition to this model, we also estimated a second logistic regression model that controls for a variety of additional patient- and encounter-specific covariates, including the number of distinct ED care areas and waiting rooms the patient visited during their encounter, their age, their gender, whether their NRC Health survey was conducted in English, whether the patient was placed in observation status or in a hallway bed during their encounter, whether the patient left against medical advice (AMA) or without being seen by a clinician, and finally the (logarithm of) LOS in hours. To enable comparison across ED areas, all area-specific censuses were

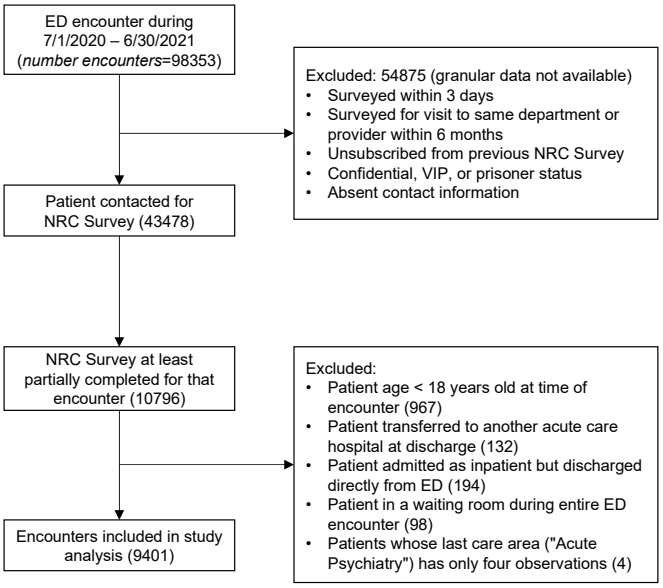

Figure 1. Inclusion criteria flow chart.
ED, emergency department, *NRC*, National Research Corporation.

standardized (ie, the mean for that area was subtracted, and the result then divided by that area census' standard deviation).

We evaluated the discriminative performance of the predictive models using the area under the receiver operating characteristic curve (AUC), also known as the C-statistic or concordance statistic, a standard measure for assessing the ability of classification models to identify a binary outcome. Coefficients of the models are presented in terms of odds ratios (for detractors relative to non-detractors), and all confidence intervals (CI) were reported at the 95% level. We conducted all statistical analyses in R version 4.1.3 (R Foundation for Statistical Computing, Vienna, Austria).[34] In the Supplement we also include several other logistic regression models, which distinguish between boarder and non-boarder patient census.

RESULTS

Descriptive Analysis

For the period studied, the survey response rate was 24.8%. A summary of detractor characteristics and differences in patient census and boarder-specific census is shown in **Table 2**. Overall, 13.9% of survey responders were detractors, with significant variability across the different ED locations (lowest in Care Area G and highest in Care Area B). Further, there was a significant difference in the average overall ED census for detractors (an average of 3.70 more patients, (95% CI 2.33-5.07), with the relative magnitude of the effect varying by care area. There was significant variability in terms of the boarder census across locations (such as Care Area F, with a large proportion of boarders, vs Care Area D).

Predictive Analysis

The coefficients of the two multivariable logistic regression models are shown in **Table 3**. The AUC for the unadjusted model, based on each patient's last ED location and the census of that area at the patient's arrival, was 0.594 (CI 0.577-0.610). Three locations showed statistically significant differences in the odds ratios of detractor likelihood with changes in the area's patient census: Care Area A (OR 1.47, CI 1.15-1.91), Care Area B (OR 1.21, CI 1.10-1.33), and Care Area D (OR 1.52, CI 1.14-2.05) (Table 3 and **Figure 2**). In contrast, the adjusted model (which controls for several patient- and encounter-specific covariates) has a higher AUC compared with our unadjusted model 0.673 [0.657-0.690], $P<0.001$, *cf.* Supplement, Supporting Table 2), with the same three locations having a significant difference for changes in patient census: Care Area A (1.34 [1.04-1.74]), Care Area B (1.15 [1.04-1.27]), and Care Area D (1.38 [1.03-1.87]).

Among encounter-related covariates in the adjusted model, three were significant: LOS (1.71 [1.50-1.95], **Table 3**); leaving AMA or leaving without being seen (LWBS) (5.15 [3.84-6.89], Table 3); and the number of distinct ED care areas a patient visits (1.16 [1.01-1.33], Table 3). Several other measures (number of distinct waiting rooms a patient visits, whether patient is placed in a hallway bed, and whether patient is placed in observation status during their encounter) were not. The three patient-specific covariates were all significant in the adjusted model (age, gender, and whether the patient's survey was conducted in English).

DISCUSSION

In this retrospective cohort study, we aimed to assess how the patient-reported experience of discharged ED patients is impacted by ED crowding as measured by ED census and boarder burden. Overall, we found that discharged patients are more likely to have a negative patient

Table 2. Summary statistics on survey response and average number of patients (and boarders) at the time of a patient's arrival to their last care area.*

Last care area	Number of encounters with survey data (percent of total)	Detractor percentage	Average number of patients in area (SD)	Difference in area patient census means (SE)	Average number of boarders in area (SD)	Difference in area boarder means (SE)
A	645 (6.86)	13.95	6.20 (2.14)	0.74 (0.22)	0.00 (0.00)	0.00 (0.00)
B	2,907 (30.92)	17.65	26.01 (6.56)	1.22 (0.32)	5.69 (3.29)	0.20 (0.16)
C	1,877 (19.97)	12.47	7.66 (3.18)	0.21 (0.22)	0.31 (0.65)	0.00 (0.04)
D	485 (5.16)	10.52	6.69 (2.96)	1.24 (0.45)	0.01 (0.10)	0.01 (0.02)
E	829 (8.82)	16.28	28.46 (4.54)	-0.16 (0.41)	4.98 (3.65)	-0.66 (0.32)
F	750 (7.98)	10.00	21.31 (5.90)	0.57 (0.73)	5.97 (3.62)	-0.34 (0.39)
G	321 (3.41)	5.92	7.29 (2.72)	0.87 (0.59)	0.35 (0.66)	0.19 (0.24)
H	1,587 (16.88)	11.66	20.77 (4.94)	0.65 (0.40)	1.09 (1.22)	-0.07 (0.09)
Overall	9,401 (100.00)	13.85	131.28 (23.71)	3.70 (0.70)	18.77 (10.08)	0.69 (0.31)

*"Detractor percentage" is the percent of detractors among all patients with at least some survey data (i.e., non-response to the facility recommendation question is counted as a non-detractor). Differences are measured as mean patient census in care area for Detractors minus non-detractors. The 'Overall' row indicates the number of patients (and boarders, respectively) in the ED in total (ie, not localized to that specific area) at the time of the patient's arrival to their last care area.

Table 3. Logistic regression models for estimating a patient's detractor likelihood.*

	Unadjusted model			Adjusted model		
Predictors	Odds ratios (SE)	CI	*P* value	Odds ratios (SE)	CI	*P* value
(Intercept)	0.15 (0.02)	0.12 – 0.19	<0.001	0.11 (0.02)	0.07 – 0.17	<0.001
Last location						
A	1.00	reference		1.00	reference	
B	1.38 (0.18)	1.07 – 1.78	**0.013**	0.71 (0.11)	0.52 – 0.96	**0.025**
C	0.92 (0.13)	0.71 – 1.22	0.562	0.63 (0.09)	0.47 – 0.85	**0.002**
D	0.71 (0.14)	0.48 – 1.04	0.085	0.63 (0.13)	0.42 – 0.93	**0.023**
E	1.26 (0.19)	0.94 – 1.71	0.125	0.68 (0.12)	0.48 – 0.96	**0.03**
F	0.72 (0.12)	0.51 – 1.00	0.053	0.43 (0.08)	0.30 – 0.63	**<0.001**
G	0.39 (0.11)	0.22 – 0.65	**0.001**	0.19 (0.05)	0.10 – 0.32	**<0.001**
H	0.85 (0.12)	0.65 – 1.13	0.258	0.40 (0.09)	0.26 – 0.62	**<0.001**
Patients in area (standardized) * Last location						
A	1.47 (0.19)	1.15 – 1.91	**0.003**	1.34 (0.17)	1.04 – 1.74	**0.027**
B	1.21 (0.06)	1.10 – 1.33	**<0.001**	1.15 (0.06)	1.04 – 1.27	**0.007**
C	1.07 (0.07)	0.93 – 1.22	0.351	1.09 (0.08)	0.94 – 1.25	0.261
D	1.52 (0.23)	1.14 – 2.05	**0.005**	1.38 (0.21)	1.03 – 1.87	**0.034**
E	0.97 (0.09)	0.80 – 1.16	0.711	0.94 (0.09)	0.78 – 1.13	0.506
F	1.10 (0.13)	0.87 – 1.40	0.427	1.06 (0.13)	0.83 – 1.36	0.622
G	1.37 (0.33)	0.86 – 2.20	0.179	1.33 (0.32)	0.83 – 2.16	0.237
H	1.14 (0.09)	0.98 – 1.34	0.093	1.07 (0.09)	0.91 – 1.25	0.415
Age in years				0.99 (0.00)	0.98 – 0.99	**<0.001**
Gender						
Female				1.00	reference	
Male				0.60 (0.04)	0.52 – 0.67	**<0.001**
Survey completed in English				1.62 (0.16)	1.34 – 1.97	**<0.001**
Number of ED care areas visited				1.16 (0.08)	1.01 – 1.33	**0.031**
Number of ED waiting rooms visited				1.06 (0.07)	0.93 – 1.22	0.38
Placed in Observation status				1.08 (0.15)	0.82 – 1.43	0.575
Placed in hallway bed				1.07 (0.09)	0.91 – 1.25	0.409
Patient leaves AMA or LWBS				5.15 (0.77)	3.84 – 6.89	**<0.001**
Length of stay in hours (logarithm)				1.71 (0.11)	1.50 – 1.95	**<0.001**
AUC (CI)	0.594 (0.577 – 0.610)			0.673 (0.657 – 0.690)		

* The number of patients present in the specific area is standardized (ie, mean is subtracted, and the result is divided by the standard deviation) to allow comparison across different areas; therefore, a unit increase equates to an increase in one standard deviation. P-values below 0.05 are bolded. Odds ratios greater than 1.0 correspond to increased likelihood of being a detractor.
SE, standard error; *CI*, confidence interval; *ED,* emergency department; *AMA*, against medical advice; *LWBS*, left without being seen; *AUC*, area under the receiver-operator characteristic curve.

experience if ED crowding is worse at the time of their arrival. We found that within our lower acuity care areas (Care Area A, Care Area B, and Care Area D) increased ED census at the time of the patient's arrival increased the likelihood of the patient being a detractor as measured by the net promotor score. Moreover, discharged patient experience was generally rated lower in the lower acuity care areas as compared to the higher acuity care areas. There was no statistically significant impact of patient census on patient experience in the higher acuity care areas.

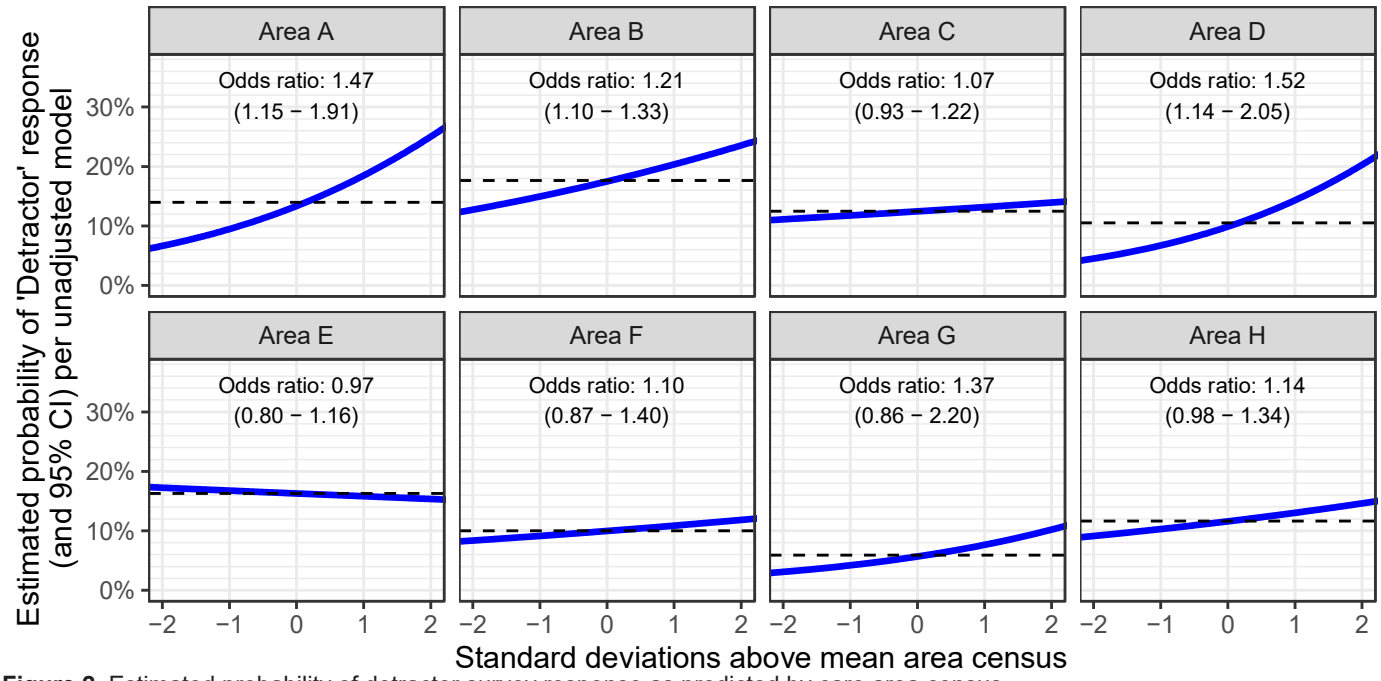

Figure 2. Estimated probability of detractor survey response as predicted by care area census.
CI, confidence interval

Given the myriad known effects of ED crowding on operational metrics and clinical outcomes, it is unsurprising that discharged ED patients feel the impact of crowding and have a worsened patient experience when ED resources are stretched thin. Our findings suggest that although ED crowding increases the likelihood of a patient reporting a negative experience, there are many variables that impact patient experience that we are not capturing in our surveys and data. Our fully adjusted model considered several potential confounding factors, such as age, patient gender, and whether a patient ultimately left AMA or without being seen by a clinician. The fully adjusted model did show an increased AUC compared with our unadjusted model, concomitant with a decrease in the odds ratios for the three areas with significant differences.

This attenuation in odds ratios is expected given the partially mediating influence of several of the covariates included in the adjusted model. For example, increased LOS is well known to be correlated with increased measures of ED crowding, [35] and we found that increase as well. Likewise, we also saw that a patient leaving AMA or LWBS has a large-magnitude odds ratio for being a detractor in our model, and increased AMA/LWBS rates are associated with crowding as well.[1] Despite including these covariates, the AUC for our model was 0.673 [0.657-0.690], suggesting that a large portion of the variation in a patient being a detractor is unexplained by our model. We suspect that some of this variation would be explained by other confounding variables that we were unable to measure, such as time until imaging acquisition or time until completion of specialty consultation. Other potential variables, which may explain some of this variation, may be more difficult to measure with our existing surveys, such as the way in which clinician experience on crowded days manifests itself in patient interactions.

LIMITATIONS

This study had several limitations. The primary limitation was that a large majority of discharged patients (86.1%) were non-detractors, limiting our ability to assess factors that predict being a detractor. While statistically significant, the effect size of the ED census on patient experience was rather small. There are also standard limitations associated with using survey data, as patient populations with limited access to technology or with unstable housing are less likely to respond to the survey. Finally, this was a retrospective, single-site study, which limits the generalizability of our results.

Although ED crowding has previously been clearly associated with several negative clinical and operational outcomes, as well as worsened patient experience for admitted patients,[36] this is the first study we are aware of that specifically illustrates the impact of ED crowding on the experience of discharged patients. As most patients seen in the ED are ultimately discharged, and discharged patients represent the unique group whose experience is limited to their time in the ED, their experience should be of particular interest to ED leaders seeking to measure the impact of interventions or improvement efforts. Intuitively, we thought it was likely that ED crowding would indeed lead to worsened patient experience. We were surprised, however, by the degree of variance in the data, even with adjustment for covariates commonly thought to impact patient experience.

CONCLUSION

Our study shows that patients who arrive to a crowded ED and are ultimately discharged are more likely to have a negative patient experience than those who arrive at times of less crowding. It is, therefore, important that we continue to combat ED crowding and boarding to improve discharged patient experience. Future studies are needed to understand whether our results are generalizable to other ED settings, to identify underlying sources of variation in patient experience based on care area characteristics, and to better characterize which variables are most impactful on the patient experience of discharged ED patients.

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Patient-Centered Outcomes of an Emergency Department Social and Medical Resource Intervention

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Introduction: Few studies have examined the impact of emergency department (ED) social interventions on patient outcomes and revisits, especially in underserved populations. Our objective in this study was to characterize a volunteer initiative that provided community medical and social resources at ED discharge and its effect on ED revisit rates and adherence to follow-up appointments at a large, county hospital ED.

Methods: We performed a cross-sectional analysis of ED patients who received medical and social resources and an educational intervention at discharge between September 2017–June 2018. Demographic information, the number of ED return visits, and outpatient follow-up appointment adherence within 30 and 90 days of ED discharge were obtained from electronic health records. We obtained data regarding patient utilization of resources via telephone follow-up communication. We used logistic regression analyses to evaluate associations between patient characteristics, reported resource utilization, and revisit outcomes.

Results: Most patients (55.3% of 494 participants) identified as Latino/Hispanic, and 49.4% received healthcare assistance through a local governmental program. A majority of patients (83.6%) received at least one medical or social resource, with most requesting more than one. Patients provided with a medical or social resource were associated with a higher 90-day follow-up appointment adherence (odds ratio [OR] 2.56; 95% confidence interval [CI] 1.05-6.25, and OR 4.75; 95% CI 1.49-15.20], respectively), and the provision of both resources was associated with lower odds of ED revisit within 30 days (OR 0.50; 95% CI 0.27-0.95). Males and those enrolled in the healthcare assistance program had higher odds of ED revisits, while Hispanic/Latino and Spanish-speaking patients had lower odds of revisits.

Conclusion: An ED discharge intervention providing medical and social resources may be associated with improved follow-up adherence and reduced ED revisit rates in underserved populations.
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INTRODUCTION

In the last two decades, the growth in the number of annual emergency department (ED) visits in the United States has outpaced the number expected by population growth by nearly two-fold.[1,2] There has been a concomitant increase in the proportion of safety-net EDs serving high volumes of patients who are underinsured or enrolled in Medicaid.[3,4] These trends are in part due to health inequities ingrained by social structures

and economic systems, known as social determinants of health (SDoH).[5] Both race/ethnicity and socioeconomic status have been strongly associated with disparities in attendance at safety-net hospitals as well as morbidity and mortality.[5-10] Repeated ED utilization is also linked to higher mortality rates, especially in elderly patients.[11] Patients with frequent ED revisits have limited connections to community resources and reduced comprehension of discharge instructions.[12] Decreasing ED revisits may help alleviate high ED volumes, which are associated with increased in-hospital mortality, longer times to treatment initiation, and a higher likelihood of leaving against medical advice.[13-15]

There is a growing body of literature on the effectiveness of linking patients to primary care services from the ED and addressing SDoH to decrease hospital crowding.[16,17] The ED is uniquely positioned to serve as a critical site to facilitate addressing social needs and promoting these linkages.[18-20] For example, the Health Leads model and Highland Health Advocates both use help desks to connect patients to community-based resources from the ED; however, there remains a lack of evidence regarding how these approaches impact ED utilization outcomes.[21,22] Further, there is limited literature describing the utilization of social worker services, case management, and implementation of community interventions from an ED setting.[23-25]

Housing status, food insecurity, employment status, insurance status, education status, ability to pay for utilities, and availability of transportation are SDoH domains that can be targeted for intervention by multidisciplinary teams.[26-28] While there are promising results from studies using vertical approaches that address one single SDoH domain, there are limited studies that have investigated the impact of programs that target multiple SDoHs.[29,30] In this study we sought to assess a volunteer initiative that provided community medical and social resources at ED discharge and its effect on ED revisit rates and adherence to follow-up appointments at a large, county hospital ED.

Population Health Research Capsule

What do we already know about this issue?
The ED is uniquely positioned to address patients' social needs and promote linkages to community services, but limited evidence exists describing linkage models.

What was the research question?
Are health system utilization outcomes impacted if patients are provided community resources at ED discharge?

What was the major finding of the study?
Patients receiving resources had lower odds of ED revisit at 30 days and a higher 90-day follow-up appointment adherence.

How does this improve population health?
Providing resources upon ED discharge through a standardized process may reduce ED revisits and encourage outpatient follow-up.

METHODS

Study Design and Setting

We conducted a retrospective, cross-sectional study of ED patients at a large, county hospital (89,000 annual ED visits) in Houston, TX, who received a volunteer patient discharge intervention between September 1, 20171–June 1, 2018. This service was provided by a student-led organization of roughly 60 undergraduate volunteers from a nearby university. Texas did not expand Medicaid coverage under the Affordable Care Act, and most patients in this health system are underinsured or use a county financial assistance program (FAP) for medical services within the hospital system.[31,32] This study received institutional review board approval.

Intervention

Volunteers underwent biannual eight-hour trainings covering intervention procedures, resources provided to patients, and simulations of common patient encounters (Supplemental File 1). Spanish language competency of volunteers was assessed by native speakers. Teams of 3-4 volunteers with one supervising "shift leader" rotated from 1 PM-9 PM Monday to Saturday through a lower acuity treatment area for patients with an Emergency Severity Index of 3 or higher. The inclusion criterion was any patient marked for discharge in the care area displayed on the care area electronic board. Volunteers reviewed the patient with a nurse to confirm discharge status and to obtain the after-visit summary. Patients to be discharged to a skilled nursing facility, in-patient rehabilitation, or correctional facility were not approached. Low-acuity treatment areas were targeted as they had individual patient rooms with space for the volunteer teams to deliver the intervention and had a higher proportion of patients discharged compared to high-acuity areas.

Patients who agreed to participate were asked questions from a standardized questionnaire to gather demographic information. Interventions were conducted in English or Spanish depending on patient preference. Patients were then provided a standardized educational intervention that involved reviewing their medication list and follow-up appointments and emphasizing the importance of medication and appointment adherence. Finally, patients were offered information on a variety of local and federal social and medical resources given in their preferred language. Resources were provided based on patients' interest in receiving each resource. Medical resources included information on prescription discount cards, lists of pharmacies, primary care clinics, or low-cost dental clinics. Social resources included information on programs such as

FAPs for rent, supplemental nutrition programs, and subsidized transportation programs. Each intervention lasted 5-15 minutes.

Patients were called one week after discharge by volunteers and asked questions from the standardized questionnaire regarding medication adherence, adherence at follow-up appointments, and utilization of resources that they received in the ED. Two additional attempts were made to reach patients who did not answer the first call at 30 minutes and again at one week after.

Data Collection

Patient responses during the intervention and follow-up calls were recorded using standardized forms. Additional patient information including demographics, ED chief complaint, and outcome variables was obtained from electronic health records (EHR) and recorded in a standardized tool. We used the patients' listed ZIP codes as a proxy for socioeconomic status,[33] and median household income data was obtained from the 2013-2017 American Community Survey.[34] Data was de-identified and stored in a secure database.

Outcomes

The primary outcome was the frequency of ED revisits to any Harris County-funded hospital, with a secondary outcome of adherence to follow-up clinic appointments. Revisits and appointment adherence were evaluated within 30 and 90 days after initial ED discharge, as prior studies have used these times as endpoints, and more than 30 days may be required to enroll or experience impact from new services.[35-37] The 90-day outcomes were inclusive of ED revisits and appointment attendance within the initial 30 days.

Analysis

Patients who were less than 18 years of age or pregnant at the time of the intervention were excluded from data analysis. We also excluded patients with missing identifying information on the standardized forms. Patient characteristics and outcomes were analyzed using descriptive and inferential statistics. We used binomial logistic regression to assess the relationship among independent variables (patient demographics, type of resources provided at ED discharge, and reported resource utilization at follow-up call) and dependent variables (follow-up appointment adherence and ED revisits), using SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY). We performed a residuals analysis to identify outliers with standardized residuals greater than 2.5 standard deviations, which were removed from the final analysis.

RESULTS

Characteristics of Study Subjects

A total of 614 patients received the intervention during the study period (**Figure**). Patients below 18 years of age (104), pregnant at the time of discharge (7), or with missing medical record numbers or ED visit dates (9) were excluded. We included a final 494 patient encounters in the data analysis. The median

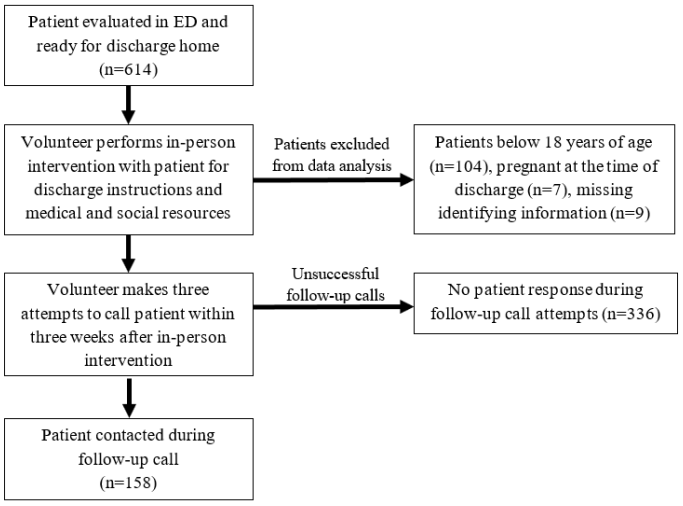

Figure. Educational intervention workflow showing the steps performed when discharging and following up with patients. *ED*, emergency department.

Table 1. Characteristics of patients who received intervention.

Characteristic	Number (%) / median (IQR)
Age (median years)	43 (31 - 53)
Gender	
Female	273 (55.3)
Male	221 (44.7)
Race/ethnicity	
Black	152 (30.8)
White	48 (9.7)
Hispanic/Latino	273 (55.3)
Other	21 (4.3)
Preferred language	
English	316 (64.0)
Spanish	174 (35.2)
Other	2 (0.4)
Unknown	2 (0.4)
ZIP code household median income quintile	
1st quintile ($26,644 - $47,297)	290 (58.7)
2nd quintile ($47,297 - $69,446)	146 (29.6)
3rd-5th quintiles ($69,446 - $180,758)	53 (10.7)
Unknown	5 (1.0)
Insurance status	
Uninsured	165 (33.4)
County financial assistance program	244 (49.4)
Public/private insurance	67 (13.6)
Unknown	18 (3.6)
Resource requested	
No resources	81 (16.4)

IQR, interquartile range; *ED*, emergency medicine.

Table 1. Continued.

Characteristic	Number (%) / median (IQR)
Social resources only	71 (14.4)
Medical resources only	88 (17.8)
Both resources	254 (51.4)
Resources used as reported on follow-up call	
Not reached by phone	336 (68.0)
Reached by phone and did not use resources (or no resources given)	77 (15.6)
Reached by phone and reported resource use	81 (16.4)
Outcomes	
Any ED revisit within 30 days	76 (15.4)
Number of ED revisits within 30 days (median visits)	1 (1)
Any ED revisit within 90 days	114 (23.1)
Number of ED revisits within 90 days (median visits)	1 (1 - 2)
Attendance of follow-up appointment within 30 days	185 (72.5)
Attendance of follow-up appointment within 90 days	240 (75.0)

IQR, interquartile range; *ED*, emergency medicine.

Table 2. Most common medical and social resources requested by patients through the intervention.

Resource	Number given (% of total patients)
Top 5 medical resources given	
Low-cost dental clinic information	216 (43.7)
Primary care clinic information	205 (42.0)
List of local pharmacies	147 (29.8)
Information card for local medical insurance	126 (25.5)
Prescription discount card	122 (24.6)
Top 5 social resources given	
General information sheet on food and insurance assistance	234 (47.4)
Information on local financial and utility bill assistance	61 (12.3)
List of homeless shelters and emergency housing options	59 (11.9)
Information on English as a second language courses	58 (11.7)
Application for local transportation assistance services	49 (9.9)

patient age was 43 years (**Table 1**). Most patients were female (55.3%), and the majority identified as Latino/Hispanic (55.3%). Primary Spanish speakers made up over one third (35.2%) of all patients. The most frequent chief complaints were abdominal pain (19.6%), generalized pain (8.5%), and headache (6.1%). About half of the patients (49.4%) were enrolled in the county healthcare FAP. We found that 33.4% of patients were uninsured, and only 13.6% had insurance coverage. These characteristics overall reflected the general ED population at this hospital.[31]

Main Results

A total of 413 patients (83.6%) requested at least one resource at discharge, with 329 (66.6) requesting more than one resource. The most requested medical and social resources were dental care information and information on food and insurance assistance, respectively (**Table 2**). From 494 ED encounters included in this study, volunteers contacted 158 patients (32%) in a follow-up call one week after discharge. Compared to patients who were not successfully contacted, this patient population did not significantly differ in gender ($P = 0.29$), race/ethnicity ($P = 0.18$), language ($P = 0.89$), or insurance status ($P = 0.12$). Of the contacted patients, 81 (51.3%) reported using a resource received from the intervention. Of all patients, 76 (15.4%) returned to the ED at least once within 30 days of discharge, and 114 (23.1%) returned within 90 days.

Components of our intervention were associated with improved outcomes of decreased odds of ED revisits and improved attendance of follow-up appointments (**Table 3**). Patients who requested both medical and social resources from the intervention was associated with lower odds (odds ratio [OR] 0.50, 95% confidence interval [CI] 0.27-0.95) of an ED revisit at 30 days compared to those requested no resources. Those who reported using a resource received from the intervention (OR 0.46, 95% CI 0.24-0.92) had lower odds of revisiting at 90 days. There were higher odds of outpatient follow-up appointment adherence for patients who received a social resource at discharge (OR 4.75, 95% CI 1.49-15.20), and those who received a medical resource (OR 2.56, 95% CI 1.05-6.25).

We observed a difference in the odds of ED revisits and attendance of follow-up appointments associated with some patient characteristics. Increased odds of an ED revisit within 30 days of discharge were seen in males (OR 1.76, 95% CI 1.07-2.88) and patients enrolled in the county FAP (OR 2.11, 95% CI 1.15-3.87). Males also had higher odds (OR 1.91, 95% CI 1.25-2.91) of revisiting at 90 days. Patients in the 3rd-5th quintile median household income had lower odds of attendance to follow-up appointments within 30 days of ED discharge (OR 0.38, 95% CI 0.16-0.90).

In contrast, primarily Spanish speakers had lower odds of an ED revisit (OR 0.53, 95% CI 0.33-0.85) and higher odds of attending at least one follow-up appointment at 30 and 90 days. Hispanic/Latino patients had lower odds of revisiting the ED within 90 days compared to Black patients (OR 0.52, 95% CI 0.33-0.83) as well as higher odds of follow-up attendance at 30 and 90 days. Patients enrolled in a county FAP also had higher odds of follow-up attendance compared to uninsured patients.

Table 3. Logistic regression analysis of 30- and 90-day follow-up appointment attendance and emergency department revisit.

Characteristic	30-day ED revisit OR (95% CI)	90-day ED revisit OR (95% CI)	30-day follow-up appointment attendance OR (95% CI)	90-day follow-up appointment attendance OR (95% CI)
Gender				
Female			Reference	
Male	*1.76 (1.07-2.88)	*1.91 (1.25-2.91)	0.83 (0.48-1.44)	0.83 (0.50-1.38)
Race/ethnicity				
Black			Reference	
Hispanic/Latino	0.62 (0.36-1.07)	*0.52 (0.33-0.83)	*2.86 (1.52-5.40)	*3.29 (1.86-5.83)
White	0.72 (0.30-1.78)	0.98 (0.48-2.00)	0.62 (0.25-1.57)	2.10 (0.81-5.41)
Preferred language				
English			Reference	
Spanish	0.72 (0.42-1.23)	*0.53 (0.33-0.85)	*2.00 (1.12-3.57)	*2.56 (1.4-4.50)
ZIP code median household income quintile				
1st Quintile			Reference	
2nd Quintile	0.97 (0.55-1.70)	0.93 (0.58-1.51)	1.03 (0.55-1.92)	0.73 (0.42-1.29)
3rd-5th Quintiles	1.50 (0.7-3.15)	1.64 (0.86-3.10)	*0.38 (0.1-0.90)	0.47 (0.2-1.03)
Insurance status				
Uninsured			Reference	
Public/private Insurance	1.26 (0.51-3.11)	1.41 (0.70-2.85)	0.68 (0.28-1.65)	0.57 (0.25-1.28)
County financial assistance program	*2.11 (1.15-3.87)	1.63 (0.99-2.69)	*2.01(1.03-3.91)	*1.89 (1.02-3.50)
Resources requested				
No resources			Reference	
Social resources	0.60 (0.26-1.36)	0.65 (0.31-1.35)	3.28 (1.15-9.36)	*4.75 (1.49-15.20)
Medical resources	0.52 (0.23, 1.14)	0.54 (0.2-1.09)	2.48 (0.97-6.31)	*2.56 (1.0-6.25)
Both	*0.50 (0.27-0.95)	0.63 (0.3-1.11)	1.63 (0.8-3.26)	1.23 (0.65-2.33)
Resources used as reported on follow-up call				
Not reached by phone			Reference	
Reached by phone and did not use resource	0.83 (0.41-1.68)	0.90 (0.5-1.61)	1.42 (0.66-3.09)	1.43 (0.67-3.04)
Reached by phone and reported resource use	0.63 (0.30-1.32)	*0.46 (0.24-0.92)	1.00 (0.46-2.16)	0.94 (0.48-1.87)

* $P < 0.05$.
CI, confidence interval; *OR*, odds ratio.

DISCUSSION

Our findings indicate that ED discharge interventions focused on patient needs and providing social and medical resources may assist in promoting appropriate patient access to the healthcare system after ED discharge. The most requested resources were information on local dental, primary care, and pharmacy services, as well as food and health insurance resources. Similar needs were identified in surveys of ED patients who made early or frequent returns to the ED after their initial ED discharge.[38,39] These patients reported difficulty scheduling a primary care appointment, attending outpatient appointments due to lack of insurance, and finding transportation to attend follow-up appointments.[38,39]

In our study, patients who requested both social and medical resources had lower rates of adherence to follow-up compared to those who requested only one category of resources, possibly indicating that patients with multiple needs had more barriers to appointment adherence. Furthermore, patients reported the discharge process of their initial ED visit was rushed, unprepared, and left them confused.[38] Our

volunteer-led service was designed to address these factors more comprehensively during ED discharge.

Despite identified patient needs, interventions dedicated to providing SDoH resources are sparse. Wassmer et al described using a peer counseling program that provided education on medical and social needs in the ED.[40] Patients who had visited the ED four or more times in the previous year were counseled during their ED visit and in subsequent visits, with a decrease in ED utilization over two years extending past the follow-up period of the study.

A population-based approach to ED social interventions may improve the effectiveness of addressing SDoH by identifying risk factors for ED revisits and developing interventions to target specific population needs. This study found that male gender, Black race, and use of the county FAP were associated with increased odds of in-system ED revisits. Other studies have reported mixed results on the association between these factors and ED usage. One study found an association between male gender and higher ED revisit rates in older adults.[11] However, others demonstrated no such association or an inverse association,[41-44] which likely demonstrates that the impact of gender may be influenced by other risk factors. Multiple studies have demonstrated higher ED revisit rates among Blacks compared to other ethnic groups; however, this may be due to differences in average income, enrollment in Medicare and Medicaid, implicit bias against this group within medical systems, and lack of access to primary care physicians.[39,44,45]

The impact of using a healthcare FAP for addressing healthcare costs has not been well characterized. Similar to the findings in this study, Wassmer et al found that patients receiving financial assistance from a county program in California had higher utilization of the ED,[40] which was speculated to be due to younger, lower income patients on financial assistance than those enrolled in public insurance programs. Interestingly, although the use of a county FAP was associated with increased odds of ED revisit, this was also associated with increased odds of follow-up appointment attendance at 90 days post-discharge. Possibly, the cost of appointments is ameliorated by the assistance program, and for similar reasons these patients receiving financial assistance may be less deterred from revisiting the ED.

Our study differed from preceding literature on the impact of English proficiency. Ngai et al demonstrated that patients with limited English proficiency have a higher likelihood of an unplanned ED visit within 72 hours of ED discharge compared to English speakers, even after adjusting for potential confounders.[46] The opposite trend was observed in this study, with lower odds of a return to the ED within 90 days in primary Spanish speakers. The reason for this is likely multifactorial. Previous studies suggest that less acculturated Hispanic adults, measured by citizenship status and length of stay in the US, use fewer healthcare resources overall than more acculturated counterparts, and those who are undocumented may fear discovery and deportation, avoiding ED use for non-urgent reasons.[47,48] Finally, having a higher median income was significant for lower odds of follow-up appointment adherence, but not a significant risk factor for ED revisits. Previously, lower socioeconomic status has been established as a risk factor for increased ED utilization, but its impact on appointment adherence has been debated.[3,49]

Dedicated personnel in the ED setting are likely needed to effectively attend to patients' overlapping medical and social gaps. Many healthcare organizations employ ED social workers, case managers, and patient navigators who address the impact of SDoH through patient counseling, referrals to community services, and patient discharge planning.[50] The advantage provided by this personnel is supported by multiple systematic reviews demonstrating that their work reduces ED revisits.[24,51] However, a social worker-based intervention may not be feasible at all hospitals, which may be understaffed in high-volume, safety-net facilities treating patients with complex medical and social problems.[27]

Our study explored the possibility of using trained volunteers to perform an educational intervention. The Health Leads models similarly used volunteer patient advocates to connect patients with social resources.[21] Recruiting volunteers for our intervention allowed for more patients to be educated on available resources. Such a model may be scalable to other hospital settings, as implementation required minimal training of volunteers and an upfront investment of time to collect information about county and federal resources. In our experience, this investment was associated with a reduction of ED revisits similar to that seen in complex care coordination systems, suggesting that dedicated volunteers may serve as an adequate patient navigator proxy. Further studies are warranted to examine the impact volunteers and such ancillary staff has on patient outcomes.

LIMITATIONS

As this study used a retrospectively reviewed cross-section of patients' phone interviews and EHRs, causation cannot be inferred between the intervention and revisits or follow-up adherence. This was a single-site study at a county ED assessing patients at low-acuity units; therefore, our findings may not be generalizable to other ED settings. We were unable to collect data on a control cohort of patients who did not receive this intervention due to resource-limitations, and we did not calculate the proportion of participants of all ED patients triaged to these acuity areas during the study period. Most patients in this study were either uninsured or used a county FAP covering care for in-system healthcare services only, and there was no method to track out-of-system healthcare encounters after discharge.

We used convenience sampling to select patients during times when volunteers were present in the ED. Patients discharged during late evening or morning hours were not included, which may have skewed the characteristics of the

population studied. ZIP code data was used as a proxy for socioeconomic status and may not have been representative of each patient's income. Recall bias may be introduced via patient self-reporting of usage of medical and social resources during the follow-up call. Non-response bias may have been introduced as only one follow-up call was made, and further follow-up calls were constrained by available resources, but we did not observe a significant difference between patients who were and were not reached.

CONCLUSION

The outcomes from this intervention suggest that there is an opportunity to improve patient engagement with the healthcare system by providing resources that address social determinants of health. This suggests that a standardized in-person approach may reduce ED revisits and improve outpatient follow-up. Future investigation is needed to examine the best methods for implementation, comparing in-person and non-individualized interventions, and cost effectiveness of programs to address SDoH in the ED that meet patients' social needs and promote healthcare accessibility.

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Scoping Review: Medical Education Interventions Optimizing Social Workers in the Emergency Department

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Introduction: As the significance of social workers (SW) in improving healthcare delivery in the emergency department (ED) continues to expand, emergency physicians will increasingly be expected to effectively partner with SWs in both academic and community settings. In this scoping review we sought to provide evidence-based recommendations for effective emergency clinician educational interventions on how to incorporate SWs in the ED to address health-related social needs while also identifying directions for future research.

Methods: We conducted a systematic literature review of publications in PubMed, CINAHL, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and APA PsycINFO. A search strategy was designed in accordance with Peer Review of Electronic Search Strategies (PRESS) guidelines. Using the scoping review framework by Arksey and O'Malley, we applied consensus-based inclusion and exclusion criteria to guide study selection. A Preferred Reporting Items for Systemic Reviews and Meta-Analyses (PRISMA) flow chart delineating the selection process was generated using Covidence.

Results: Our search strategy identified nine qualifying articles for further analysis out of an initial sample of 2,119 articles. Of the nine articles that underwent full text review, 89% (8/9) evaluated a short educational didactic with or without a hands-on component to reinforce learning. Barriers to successful implementation of curricula discussed in all articles included time constraints, lack of buy-in from clinical faculty, lack of knowledge of appropriate referral sources once a problem is identified, and perceived distraction of the training from more standard clinical topics. Facilitators of curricula implementation and training success included the presence of a pre-existing and structured weekly conference schedule, ability to complete the training in a relatively short time frame or during intern orientation, presence of simulation resources, and residents' overall perceived interest in the topics.

Conclusion: Ultimately, we found that interdisciplinary learning with SWs is generally well received by participants, and we offer various suggestions on incorporation into student and resident education. Moving forward, we recommend that a standardized curriculum of working with SWs be developed using didactic sessions, simulation, and/or direct observation with feedback. [West J Emerg Med. 2023;24(2)201–205.]

INTRODUCTION

For more than 60 years, the value of social workers (SW) in medicine has been recognized.[1] The emergency department (ED) requires a multidisciplinary, team-based approach in which SWs are a vital component.[2] Although many academic EDs employ SWs and care managers, there is a lack of

standardized training for medical students, residents, attending physicians and other clinicians in the ED on how to effectively incorporate SWs into the patient care team.

As the significance of SWs in improving healthcare delivery in the ED continues to expand, particularly with respect to lowering costs, increasing patient satisfaction, improving quality, and reducing physician burnout, emergency physicians will increasingly be expected to effectively partner with SWs in both academic and community settings.[3] The SW scope of practice encompasses a wide range of services, including discharge assistance and counseling. A holistic approach renders SWs particularly valuable in addressing health-related social needs in the dynamic. safety-net setting of an ED.[3] In this literature review and scoping framework we sought to provide evidence-based recommendations for effective ED clinician educational interventions on how to incorporate social workers in the ED to address patients' health-related social needs while also identifying directions for future research.

METHODS

While serving on the Emergency Medicine Residents' Association (EMRA) Social Emergency Medicine (EM) Committee, one of the authors of this study (TR) created a working group to improve education in social EM. Specifically, the purpose was to investigate existing literature related to educating residents and medical students on ED care models that include SWs and care managers, and to create resources to assist members in implementing multidisciplinary care models as part of their training programs. Using Peer Review of Electronic Search Stratregies (PRESS) guidelines, we conducted a systematic literature review in PubMed, CINAHL, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and APA PsycINFO.[5] We developed the search threads after categorizing the four necessary elements of our research question: curriculum; students; social work; and emergency setting. The **table** illustrates the search terms used.

We established inclusion and exclusion criteria. Two authors (TR and HP) reviewed respective abstracts for potential relevance based on search results. The same two authors achieved consensus after resolving differences through real-time rigorous comparison of articles to predefined inclusion and exclusion criteria. Two other authors (TR and HP) reviewed the full text of selected abstracts and independently assessed their relevance. For any disagreements, all four authors convened for real-time comparison to predefined inclusion and exclusion criteria. This process led to a group consensus for a final decision for all remaining full-text articles. The reference section for each included article was checked for additional articles that were otherwise missed in the initial search.

We used the web-based tool Covidence (Melbourne, Australia) to facilitate study selection. We performed the final two steps of sorting and summarizing collected data after collectively establishing the categorization scheme. We organized articles by training level, educational strategy, evaluation methods, outcomes, facilitators to implementation, and barriers to implementation. The purpose of this categorization scheme was to provide guidance on best practices for replication of the studied educational interventions. The results of our literature search are presented in a PRISMA flow chart in the **figure**.

RESULTS

Of an initial sample of 2,119 articles, our search strategy identified nine qualifying articles for further analysis. No additional articles were detected after searching the references of the selected nine articles. The educational strategies, outcomes, and barriers to implementation discussed in these articles are summarized in a table including links to each paper that are included in the Appendix.

Table. Search strategy.

Curriculum	Students	Social Work	Emergency
"Curriculum"[Mesh]	"Internship and Residency"[Mesh]	"Social Work"[Mesh]	"Emergency Medicine"[Mesh]
OR "Education, Professional"[Mesh]	OR "Students, Medical"[Mesh]	OR "Social Workers"[Mesh]	
		OR "Community Health Workers"[Mesh]	OR "Emergency"
OR Curricul*			
OR class OR classes	OR student*	OR "Case Managers"[Mesh]	
OR course*	OR clerkship		
OR Educat*	OR intern*	OR "Interdisciplinary Studies"[Mesh]	
OR instruct*	OR resident*		
OR mentor	OR "house staff"		
OR school*		OR social work*	
OR shadow		OR case manage	
OR skill*		OR care manage*	
OR teach*		OR navigator	
OR train*			

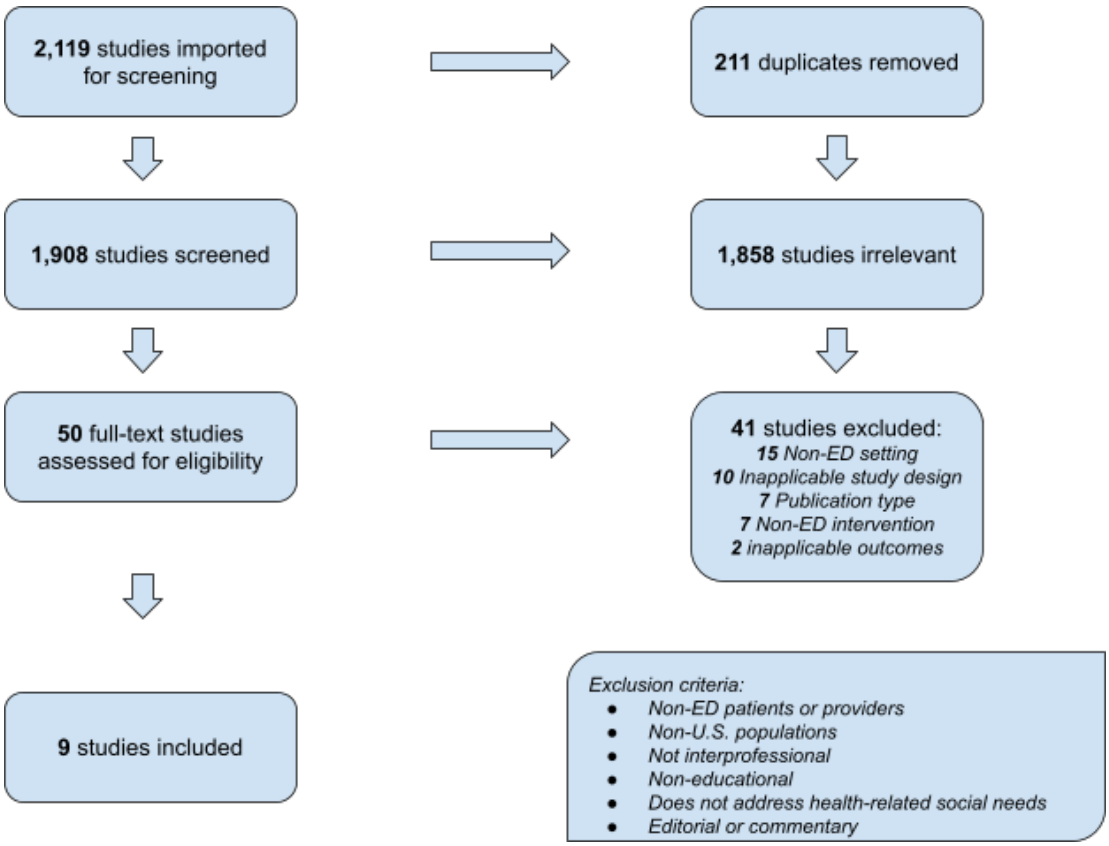

Figure. PRISMA Flow Chart
ED, emergency department; *Non-U.S*, non-United States.

Although a limited number of articles were included in the final review, we found a wide range of curricula structure, levels of time investment, and deliverables to sustain long-term impact of the educational interventions. Four of the nine articles shared a similar curricular design of an introductory didactic session followed by varying mechanisms of hands-on practice with the new skill.[6-9] Four additional articles described the use of a didactic model alone of at least one training session without hands-on practice.[10-13] The remaining article described use of hands-on training alone.[14]

Most articles described simulation cases or interactive case review. Four articles described involvement of direct patient interaction.[7,9,12,14] Three of these were directly integrated into regularly scheduled clinical shifts.[9,12,14] Five articles reported training time allotments between 20 minutes to three hours.[6,8,10,11,13] Other articles did not clearly report time requirements. Another identified educational strategy was the development of pocket-sized reference cards for participants to use for long-term reinforcement of the training.[6,10]

The included studies all entailed interdisciplinary training. Most of the included studies directly involved EM residents and/or attending physicians. Only one article reported training of medical students.[8] All studies included SWs or SW students as direct contributors to curricula development, execution, and/or attendance. Seven studies involved at least one additional specialty, such as nursing, pharmacy, or other ED staff.

Studies included evaluations of the impact of the medical interventions on trainees. Seven studies used pre- and post-intervention surveys as their primary means of analysis, most commonly assessing for self-reported confidence in the skill in question. One study objectively assessed competence in the new skill.[9] Social workers directly evaluated participants in two articles.[9,14] Results of each article were positive, with residents frequently reporting improved confidence or knowledge on the topic.

DISCUSSION

Working on the front lines, emergency physicians become intimately familiar with health-related social needs when

providing optimal care to patients. With growing recognition of the importance of interdisciplinary training, the successful incorporation of SWs into medical education has been reported in several instances in the literature. Through this scoping review, we were able to derive a framework of barriers and facilitators to guide implementation of similar educational interventions at other institutions. Of the articles that underwent full text review, 89% (8/9) described a short educational didactic with or without a hands-on component to reinforce learning. Short educational modules were likely implemented within the current paradigm of Accreditation Council for Graduate Medical Education-protected academic time, which most EM programs group as a five-hour continuous didactic time.

Barriers to successful implementation of such curricula included time constraints for new material within already established resident conference schedules, lack of buy-in from clinical faculty, lack of knowledge of appropriate referral sources once a problem is identified, and perceived distraction of the training from more standard clinical topics. Facilitators of curricula implementation and training success included the presence of a pre-existing and structured weekly conference schedule (thus reported as both a barrier to and a facilitator of implementation), ability to complete the training in a relatively short time frame or during intern orientation, presence of simulation resources, and residents' overall perceived interest in the topics.

Opportunities for inclusion of social work professionals in the medical education environment abound. Resident physicians are required to participate in weekly didactic activities including lectures, labs, asynchronous learning, simulations, grand rounds, or other forms of education that are often consolidated into a weekly conference day in which residents are not responsible for clinical duties during this protected learning time. As seen in the studies reviewed here, SW involvement in didactics was well received by resident learners, particularly in simulation scenarios and case-based learning.[6-7,10] Social workers could be recruited by organizers of residency education to host lectures or workshops on topics that they commonly deal with in the ED (eg, patient housing instability, trauma-informed care, substance use disorder/addiction) as well as lead simulation cases for residents to practice working with SWs. Similarly, medical students in the clinical stage of training could participate in this type of case-based learning either during dedicated didactic sessions or while rotating in the ED alongside the residents.

Future investigation on the most effective approach to implementation and extent of education during training is warranted, as no identified studies compared different educational models. Additionally, we found significantly more data in the literature pertaining to residents and attending physicians than to medical students. This highlights the need for greater studies on SW involvement in the training of medical students. Medical student training could help mitigate discussed barriers to curricula implementation, such as by fostering early role-modeling and advocacy of greater education on health-related social needs. Finally, more research on design of standardized curricula and incorporation into residencies is needed. This could ensure that all future emergency physicians have adequate training in working with SWs to optimally address patients' health-related social needs.

LIMITATIONS

Our methods section did not search every available database. There may be published data not stored in a public database or unpublished data. As we searched articles published as of February 2021, there may be relevant data that was published after our search.

CONCLUSION

Despite the prevalence of social workers working as part of the ED team, there remain limited examples in the literature of effective educational collaboration. None of the identified examples directly compared different educational strategies. Of existing educational models, most employ a short didactic model, which is similar to the way other topics are taught to residents. Very limited information exists on educational opportunities involving medical students and SWs. More research would be helpful to inform future standardized curricula. This review summarizes current practices in the literature and identifies areas for future research.

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The Impact of "Emergency-only" Hemodialysis on Hospital Cost and Resource Utilization

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Introduction: Undocumented immigrants are excluded from benefits that help compensate for scheduled outpatient hemodialysis (HD), compelling them to use emergency departments (ED) for HD. Consequently, these patients can receive "emergency-only" HD after presenting to the ED with critical illness due to untimely dialysis. Our objective was to describe the impact of emergency-only HD on hospital cost and resource utilization in a large academic health system that includes public and private hospitals.

Methods: This retrospective observational study of health and accounting records took place at five teaching hospitals (one public, four private) over 24 consecutive months from January 2019 to December 2020. All patients had emergency and/or observation visits, renal failure codes (International Classification of Diseases, 10th Rev, Clinical Modification), emergency HD procedure codes, and an insurance status of "self-pay." Primary outcomes included frequency of visits, total cost, and length of stay (LOS) in the observation unit. Secondary objectives included evaluating the variation in resource use between persons and comparing these metrics between the private and public hospitals.

Results: A total of 15,682 emergency-only HD visits were made by 214 unique persons, for an average of 36.6 visits per person per year. The average cost per visit was $1,363, for an annual total cost of $10.7 million. The average LOS was 11.4 hours. This resulted in 89,027 observation-hours annually, or 3,709 observation-days. The public hospital dialyzed more patients compared to the private hospitals, especially due to repeat visits by the same persons.

Conclusion: Health policies that limit hemodialysis of uninsured patients to the ED are associated with high healthcare costs and a misuse of limited ED and hospital resources.
[West J Emerg Med. 2023;24(2)206–209.]

INTRODUCTION

Over 6.500 undocumented immigrants suffer from end-stage renal disease (ESRD) requiring renal replacement therapy, most commonly hemodialysis (HD), in the United States.[1] These vulnerable patients lack access to standard three times weekly HD, do not qualify for Medicaid and Medicare dialysis benefits, and are excluded from provisions of the Affordable Care Act.[2] Undocumented immigrants have the option to buy private insurance, but at a high cost. Many are unable to afford insurance, since 40% have annual incomes

<$34,000 for a family of four or <$16,000 for an individual.[3] Given these barriers, this patient population must resort to the emergency department (ED) for emergency-only HD.

Emergency-only HD is covered under the 1986 Emergency Medical Treatment and Labor Act (EMTALA), which requires EDs to stabilize emergency medical conditions regardless of the patient's ability to pay. Emergency-only HD is provided when a patient presents to an emergency department (ED) and meets criteria for emergent or life-threatening conditions, such as hyperkalemia, uremia, volume overload, mental status changes, etc, due to untimely dialysis. Emergency-only HD has been associated with a 14-fold increase in mortality compared to standard outpatient HD.[4] Undocumented immigrants must tolerate this risk as emergency-only HD is their only option to sustain life.

Limited data is available regarding the impact of these policies on the hospital cost and resource utilization regarding emergency-only HD in the state of Georgia. Therefore, our objective in this study was to describe the impact of emergency-only HD on hospital cost and resource utilization in a large academic health system in Atlanta, Georgia.

Population Health Research Capsule

What do we already know about this issue?
Emergency hemodialysis (HD) is associated with a multiple fold increase in mortality and cost compared to standard three times weekly hemodialysis.

What was the research question?
What is the impact of emergency HD on hospital cost and resource use in an academic health system in Atlanta, Georgia?

What was the major finding of the study?
Average cost per emergency HD visit was $1,363, for an annual total cost of $10.7 million. Average length of stay per visit was 11.4 hours.

How does this improve population health?
This study highlights the cost and resource burden of emergency HD on the healthcare system and the need to seek solutions for providing standard outpatient HD.

METHODS

We conducted a cross-sectional analysis of electronic health records (EHR) and accounting records at five different teaching hospitals. We included a high-volume public hospital and four private hospitals providing care in the same large academic system. Inclusion criteria for the study were patients with an ED or observation unit visit over the two years from January 1, 2019–December 31, 2020 with either an *International Classification of Diseases, 10th Rev, Clinical Modification* code I12.x or I13.x, or a Current Procedural Terminology code 82000002 for HD and an insurance status of "self-pay." We excluded patients who were admitted to inpatient status. We obtained data from hospital EHR and from two separate accounting databases (Strata in the public hospital and EPSi in the private hospitals). The main objective was a simple description of the resource burden of emergency-only HD, including frequency of visits, total (direct and indirect) cost, and observation unit length of stay (LOS). In a secondary analysis, we evaluated the variation in resource use between persons and compared these metrics between the private and public hospitals.

We excluded 141 patients with observation unit stays of >48 hours, because they were likely miscoded hospitalized patients, as shown by correspondingly higher average cost. Statistical analysis included mean, median, sum, variance estimates, and differences in means. We used Stata Statistical Software Release 17 (StataCorp LLC, College Station, TX) for all calculations and production of all figures.

RESULTS

During the 24-month study period there were 15,682 visits for emergency-only HD by persons without insurance, excluding HD visits that resulted in hospital admission. These visits were made by 214 unique persons, for an average of 36.6 visits per person per year. The average cost per visit was $1,363, for an annual total cost of $10.7 million. The average LOS per visit was 11.4 hours. This resulted in 89,027 observation-hours annually, or 3,709 observation-days. See **Table 1** for a breakdown of metrics by public-vs-private hospital setting.

There was a high degree of variation in frequency of ED use for emergency-only HD between individuals, as shown

Table 1. Resource use by persons receiving emergency-only hemodialysis, by hospital setting.

	Total	Private	Public
Visits	15,682	566	15,116
Persons	214	61	153
Visits/person/year	36.6	4.6	49.4
Average cost ($)	1,363	1,302	1,366
Average LOS (hours)	11.4	7.5	11.5
Total annual cost (million $)	10.69	0.37	10.32
Total annual observation-days	3,709	88	3,621

LOS, length of stay.

in **Figure 1**, which plots the distribution of annual visit frequency per person by hospital setting and demonstrates the high-frequency users of the ED for HD. Not only was the overall frequency of emergency-only HD much lower in the private setting, the repeated use of emergency-only HD was also much lower in proportion, with only 16 persons receiving emergency-only HD more than once in the private hospital setting during the two-year study period.

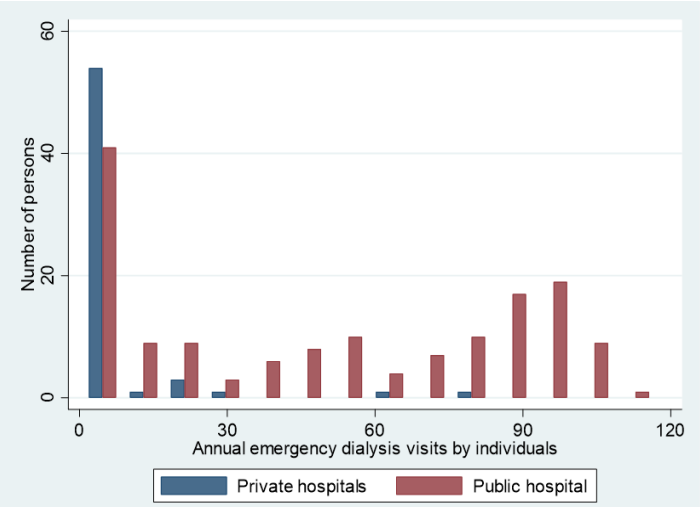

Figure 1. Distribution of annual visit frequency for emergency-only hemodialysis by individual persons, by hospital setting.

The public hospital accounted for many more episodes of emergency-only HD for uninsured persons than the private hospitals, and much of this higher volume was due to repeat visits by the same persons. Since public hospital EDs allow much more recurrent HD by individuals, there was disproportionately greater impact by the few frequent visitors in the private EDs, as demonstrated in **Table 2**. The large differences in the apparent

Table 2. Impact of repeated emergency-only hemodialysis by the same patients, by hospital setting.

	Public hospital	Private hospital	
Most frequent 10% of visitors accounted for...	20%	89%	of visits
	22%	75%	of cost
	22%	71%	of observation-days
Most frequent 20% of visitors accounted for...	38%	99%	of visits
	39%	85%	of cost
	40%	80%	of observation-days

role of hospital setting (public vs. private) did not result in much difference in cost per visit, but there was a higher length of stay required in the public hospital. These differences are shown graphically in **Figure 2**. The difference in mean LOS was 4.0 hours (95% CI 3.6-4.4), and the difference in mean cost was $63 (95% CI 22-105).

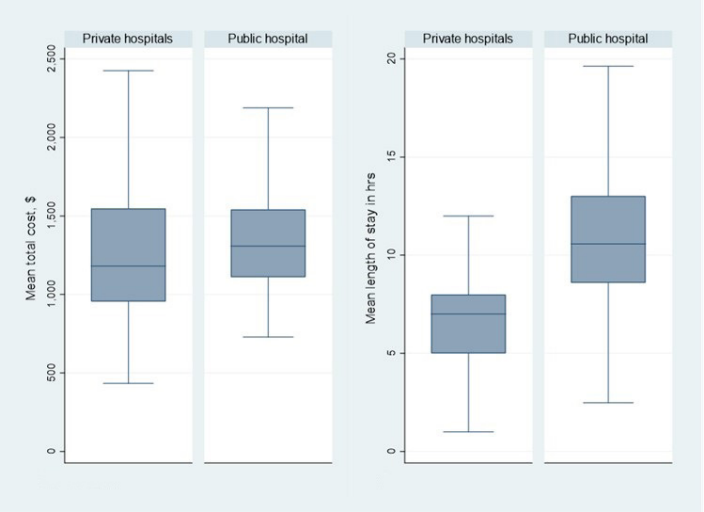

Figure 2. Box plots comparing cost and length of stay by hospital setting. Middle line is the median, box height is interquartile range, and whiskers represent Tukey minimum and maximum values.

DISCUSSION

The results of this study reveal the high healthcare costs due to health policies that restrict HD access for uninsured patients to the ED, and these costs are likely to remain uncompensated. The highest burden of providing HD to these patients falls on the public hospital as shown in this study and similar studies performed in other states.[2,5]

The practice of requiring undocumented or uninsured patients to access HD services through EDs costs more and leads to worse patient outcomes.[4] Patients who rely on emergency-only HD will often qualify for treatment fewer times than thrice weekly.[6] This has been associated with increased inpatient hospital days and mortality.[5] As previously discussed, admitted patients were excluded from this study and only emergency or observation visits were included. Hence, the high healthcare costs from this study do not include inpatient costs for this vulnerable population, and studies have shown that these patients are at increased risk of hospitalizations and intensive care unit stays.[4] Therefore, the total costs of these health policies are much higher than those presented in this study.

Efforts have been made by other states to secure funding for undocumented immigrants to receive standard outpatient dialysis, and they have been shown to reduce cost, mortality, and hospital utilization.[5,7] Approximately 13 states have expanded their emergency Medicaid provisions to reimburse standard outpatient dialysis.[8,9] Currently, Georgia's Emergency Medicaid

does not cover outpatient dialysis. To determine possible cost savings if outpatient HD were to be provided to this population, we determined the cost per encounter for outpatient HD at a private HD center in Georgia. The average total expense for one outpatient HD encounter at this center was $309. This would lead to an estimated cost of $48,204 per year per patient for thrice-weekly dialysis. Furthermore, if all the encounters in this study took place in this outpatient setting, the total cost would equal $4,845,738, saving the health system $16,536,546.

This study highlights the healthcare cost and resource burden placed on EDs and the health system by policies restricting access to scheduled, outpatient HD for uninsured/undocumented patients in Georgia. It is imperative that policymakers find alternative solutions to provide regular outpatient HD to this vulnerable population in Georgia. Our team is reaching out to stakeholders to explore solutions and will use this study to help support the initiative.

LIMITATIONS

This study does have some limitations. The insurance status of "self-pay" was used as a surrogate marker for undocumented patients, as the vast majority of undocumented immigrants with ESRD are uninsured.[10] Chart review for high-frequency users from private and public hospitals was performed to determine the reason why these patients were uninsured. All high-frequency users at the public hospital were uninsured because they were undocumented at the time of the study. Half of the high-frequency users at the private hospitals were undocumented at the time of the study. Furthermore, this study was a retrospective review of cost accounting data, and the public and private hospitals had different data sources.

CONCLUSION

Health policies that force undocumented/uninsured patients needing HD to visit the ED for emergency-only HD are associated with very high costs, misallocation of limited ED and hospital resources, and worse patient outcomes. Alternative solutions for providing regular outpatient dialysis to this vulnerable population are necessary.

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The Impact of Alcohol Sales in A College Football Stadium on Healthcare Utilization

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Introduction: In 2021, a large Midwestern university began selling alcohol to spectators within the football stadium for the first time. The stadium routinely hosts >65,000 spectators, and drinking alcohol is highly prevalent at pre-game tailgating events. Our goal in this study was to determine the impact of in-stadium alcohol sales on the incidence of alcohol-related emergency department (ED) visits and local emergency medical services (EMS) calls. We hypothesized that the availability of alcohol throughout the stadium would lead to an increase in alcohol-related patient presentations.

Methods: This was a retrospective study including patients who used local EMS and presented to the ED on football Saturdays in the 2019 and 2021 seasons. There were 11 Saturday games with seven home games each year. The 2020 season was excluded due to the impact of COVID-19- related restrictions on attendance. Trained extractors using predefined criteria reviewed records for each patient to determine whether the visit was alcohol related. Using logistic regression analysis we examined the odds of an EMS call and ED visit being alcohol-related before and after the start of stadium alcohol sales. We compared characteristics of visits before and after the onset of stadium alcohol sales using Student's t-test for continuous variables and chi-square test for categorical variables.

Results: In 2021, after the onset of in-stadium alcohol sales, there were a total of 505 emergency calls to local EMS on football Saturdays (home and away), and 29% of them were for alcohol-related incidents down from 36% of 456 calls in 2019. After adjustment for covariates, the odds of a call being alcohol-related were lower in 2021 than 2019, but this difference was not significant (adjusted odds ratio [aOR] 0.83, 95% CI 0.48-1.42). Looking specifically at the seven home games each season, the difference was more pronounced (31% of calls in 2021 compared to 40% in 2019) but not statistically significant after adjustment for covariates (aOR 0.54, 95% CI 0.15-2.03). In the ED, 1,414 patients were evaluated on game days in 2021 and 8% of them for alcohol-related reasons. This is similar to 2019, when 9% of the 1,538 patients presented due to alcohol-related complaints. After adjustment for covariates, the odds of an ED visit being alcohol-related were similar in 2021 and 2019 (aOR 0.98, 95% CI 0.70-1.38).

Conclusion: There was a decrease in alcohol-related EMS calls on home game days in 2021, although the result was not statistically significant. In-stadium alcohol sales had no significant impact on the frequency or proportion of alcohol-related ED visits. The reason for this outcome is unclear, but it is possible that fans drank less at tailgate parties knowing they could consume more once the game started. Long lines and a two-beverage limit at stadium concessions may have kept patrons from consuming excessively. The results of this study may inform similar institutions regarding the safe implementation of alcohol sales during mass-gathering events.
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INTRODUCTION

Mass-gathering events, often defined as events with greater than 1,000 people in attendance, pose significant risks for injuries and illnesses among participants. Sporting events are unique mass gatherings that have the potential to cause major public health problems, particularly when alcohol is involved. Studies have shown that college students consume significantly more alcohol on game days during the football season, which increases the incidence of high-risk behaviors, arrests, assaults, and unintended injuries.[1-3] There are significant public health and safety consequences of alcohol use in the setting of mass-gathering events at both the professional and collegiate level. Studies have linked alcohol sales to increased emergency department (ED) visits at both a Marseilles, France, football stadium and a Philadelphia, PA, ballpark.[4,5] In comparison, alcohol has traditionally not been sold in most major college football stadiums.

Since 2015, many schools have begun to allow alcohol sales within their football stadiums.[6] There is a paucity of data on the public health effects of these policy changes. In 1996, the University of Colorado at Boulder banned in-stadium alcohol sales, which resulted in a dramatic decrease in arrests, assaults, ejections, and referrals to the Judicial Affairs Office.[7] A study conducted at Ohio State University found that stricter community and university alcohol policies were associated with increased alcohol-related ED visits.[8] Studies at the University of Iowa a few years later, however, showed that stricter alcohol policies were associated with decreased incidence of blood ethanol levels in severe intoxication range, as well as a non-significant decrease in the number of alcohol-related ED visits.[9,10] Researchers at a large Midwestern university found a linear increase in alcohol-related incidents in the three years after the implementation of stadium alcohol sales.[11] An analysis of police campus records from 12 Division 1 football universities found that criminal incidents were significantly more common on game days than non-game days, but that there was no significant increase in incidents following the introduction of in-stadium sales.[6]

Although the health impact of alcohol sales is unclear, the financial benefit to the university is more predictable. West Virginia University, for example, generated an additional $700,000 in revenue after the implementation of in-stadium alcohol sales in 2011.[12] At the time, the university administration claimed that there was a reduction in alcohol-related game day incidents.[13] However, later research found that alcohol-related incidents in Morgantown, West Virginia, had increased every year since the change in alcohol sales policy.[12] The University of Texas and Ohio State University both experienced boons in revenue after starting in-stadium alcohol sales, generating in excess of $1 million.[11] As universities increasingly turn to in-stadium alcohol sales as an additional revenue source, the health consequences of this development remain unclear.

In 2021, for the first time, alcoholic beverages were available for purchase while attending a home football game at the study location, a large Midwestern university. This stadium routinely hosts >65,000 spectators, and drinking alcohol is highly prevalent at pre-game tailgating events. This represented a sharp departure from 2010 when the university implemented a series of more restrictive alcohol policies, including tailgate party restrictions and making local bars open only to those over age 21.[9]

Population Health Research Capsule

What do we already know about this issue?
Universities have recently introduced in-stadium alcohol sales at football games. The impact on local emergency medical services (EMS) utilization is unclear.

What was the research question?
Did the addition of alcohol sales at a college football stadium increase the incidence of alcohol-related EMS calls and emergency department (ED) visits?

What was the major finding of the study?
Introduction of alcohol sales resulted in no significant change in EMS calls (aOR 0.54; 95% CI 0.15-2.03), or ED visits (aOR 0.98; 95% CI 0.70-1.38).

How does this improve population health?
Our evidence shows that in-stadium alcohol sales can be introduced to large sporting events on a college campus without adversely affecting public health.

Our aim in this study was to determine the impact of this policy change on the local healthcare and emergency medical services (EMS) systems for alcohol-related complaints. We hypothesized that the wider availability of alcohol inside the stadium would lead to an increase in patients being evaluated for alcohol-related complaints. The primary outcome measures included incidence of alcohol-related emergency calls to local EMS, and incidence of alcohol-related visits to the University of Iowa Health Care (UIHC) ED. Secondary outcome measures included acuity level of alcohol-related patient presentations, hospital length of stay, and demographic factors.

METHODS

The study site was a college football stadium at a large Midwestern university. Medical care is provided by university

physicians and nurses for first-aid care inside the stadium, and local EMS provides multiple crews of paramedic and emergency medicine technician pairs as first responders for any medical emergency. Patients who are too sick or injured to be seen at the first-aid station are transported to the nearby university hospital ED.

This was a retrospective cohort study of records from county-wide ambulance service calls for service and ED hospital records. All games played in 2021 served as the exposure group, and games played in 2019 (the last full football season before the alcohol sales started in 2021) served as the control group. The 2020 season was excluded due to COVID-related effects on game attendance. Trained extractors using predefined criteria reviewed each patient treated over a 24-hour period (7 AM –7 AM) on the selected Saturdays and determined whether each ED visit or call was "alcohol related" or "not alcohol related." For example, a patient seen for an ankle sprain who was also intoxicated was considered to be an alcohol-related case. A patient seen for chest pain with no report of alcohol use was not considered to be alcohol related. We compared the number of patients and proportion of alcohol-related cases seen by local EMS and the university ED on each football Saturday in 2021 to the number in 2019.

We compared characteristics of Johnson County Ambulance Services calls and UIHC ED visits before and after the onset of stadium alcohol sales using Student's t-test for continuous variables, a chi-square test for categorical variables, and a Mann-Whitney U test for ordinal variables. We determined the odds of an EMS call or ED visit being alcohol related using logistic regression analysis. Unadjusted and adjusted odds ratios (aOR) with 95% confidence intervals are presented. A multivariable logistic regression model was developed to adjust for covariates between the two seasons, including patient age, gender, and kickoff times. We used the Hosmer-Lemeshow goodness-of-fit statistic and McFadden's R^2 to assess model fit. A small *P*-value indicates a lack of fit. We used Stata version 17.0 (StataCorp LLC, College Station, TX) for all statistical analysis.

RESULTS

There were 11 games in each season, with seven home games each year played in Kinnick Stadium in Iowa City, IA. (Games played on Fridays were excluded.) The game day characteristics between 2019 and 2021 were similar with the only differences being games decided by ≤7 points, the time of kickoff, and the outdoor temperature at kickoff (Table 1).

Ambulance Service Calls

In 2021, after in-stadium alcohol sales began, there were a total of 505 emergency calls to local ambulance services on football Saturdays (home and away), and 29% of them were for alcohol-related incidents. This is a significant decrease from 2019, when 36% of 456 calls were alcohol related (OR 0.73, 95% CI 0.54-0.98) (Figure 1, Table 2). Looking specifically at the seven home games each season, the difference was more pronounced: 31% of calls in 2021 were alcohol related compared to 40% in 2019 (OR 0.66, 95% CI 0.47-0.93). In the first six hours after kickoff (thereby excluding calls from pre-game tailgating parties and calls many hours after the game), this reduction in calls was maintained: 27% in 2021vs 44% in 2019 (OR 0.49, 95% CI 0.28-0.86). Patients with an alcohol-related call had similar average blood-alcohol levels as measured by portable breath tests in 2021 (0.23) and 2019 (0.20) (*P*=0.46). After adjustment for covariates, the odds of a call being alcohol related were lower in 2021 than 2019, but this difference was not significant (aOR 0.83, 95% CI 0.48-1.42) (Table 2). This model appeared to be a good fit to the data (McFadden's R^2=0.30, *P*=0.32). Including only home games, we found that this difference was also not significant (aOR 0.54, 95% CI 0.48-1.42). The home-only model also appeared to be a good fit to the data (McFadden's R^2=0.30; *P*=0.86).

Emergency Department Visits

In the ED, 1,414 patients were seen on game days in 2021, 8% of them for alcohol-related reasons. This is similar to 2019, when 9% of the 1,538 patients presented due to alcohol-related complaints (OR 0.87, 95% CI 0.67-1.13) (Figure 2, Table 3). On days with a home game, the proportion of ED visits that were alcohol related was slightly lower in 2021 (8.0%) than in 2019 (9.6%), but this difference was not significant (OR 0.82, 95% CI 0.60-1.13). Looking at the six hours immediately after kickoff at a home game, however, there was a significant reduction in the rate of alcohol-related ED visits in 2021 (6.7%) compared to 2019 (13.0%) (OR 0.55, 95% CI 0.32-0.97).

There was a non-significant increase in alcohol-related visits on home (9.7%) compared to away (8.6%) game days (OR 1.13, 95% CI 0.86-1.49). None of the game factors—such as kickoff time, air temperature at kickoff, victory, rivalry game, game decided by fewer than seven points, or opponent ranked in the Associated Press Top 25 poll—were correlated with more alcohol-related visits (Table 3). After adjustment for covariates, the odds of an ED visit being alcohol-related were similar in 2021 and 2019 (aOR 0.98, 95% CI 0.70-1.38). This model appeared to be an adequate fit to the data (McFadden's R^2=0.21; *P*=0.88) (Table 3). Including only home games, this difference was also not significant (aOR 0.54; 95% CI 0.28-1.03). The home-only model also appeared to be an adequate fit to the data (McFadden's R^2=0.24; *P*=0.89). Including only home games 0-6 hours after kickoff, this difference was also not significant (aOR 0.40, 95% CI 0.15-1.09). The model also appeared to be an adequate fit to the data (McFadden's R^2=0.2; *P*=0.69).

DISCUSSION

At a large Midwestern university, the onset of in-stadium alcohol sales in 2021 was not associated with an increase in alcohol-related emergencies when compared to the

Table 1. Game day characteristics of the pre- and post-stadium alcohol sales periods, 2019 and 2021 football seasons at one Midwestern university.

	No alcohol sales (2019, N=11 games)		Stadium alcohol sales (2021, N=11 games)	
Game characteristics	n	(%)	n	(%)
Home games	7	63.6	7	63.6
Victories	8	72.7	8	72.7
Games decided by ≤ 7 points	6	54.5	3	27.3
Kickoff time				
Morning	6	54.5	1	9.1
Afternoon	3	27.3	9	81.8
Evening	2	18.2	1	9.1
Kickoff temperature (°F)				
31-44	4	36.4	2	18.2
45-59	3	27.3	4	36.4
60-74	4	36.4	2	18.2
≥75	0	0.0	3	27.3
Rivalry games	3	27.3	3	27.3
Ranked inside AP top 25 poll				
Iowa Hawkeyes	11	100.0	11	100.0
Opponents	4	36.4	4	36.4

°F, degrees Fahrenheit; *AP,* Associated Press.

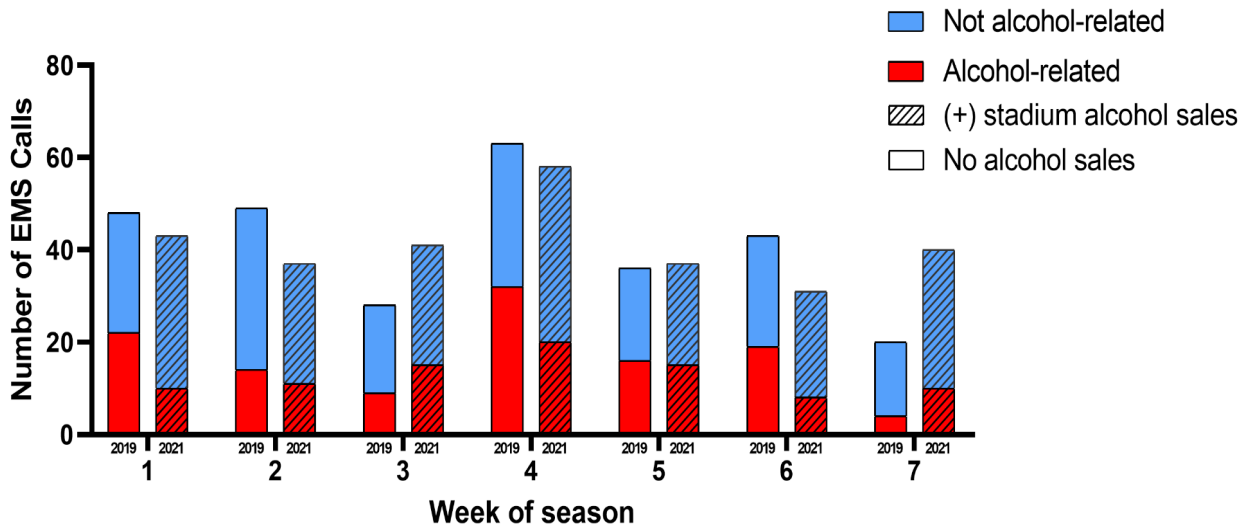

Figure 1. Number of emergency medical service calls on home game days, 2019 and 2021 seasons.

most recent full season of football games in 2019. In-stadium alcohol sales had no significant impact on the frequency or proportion of alcohol-related EMS calls or ED visits. There was a decrease in alcohol-related ED visits within six hours following kickoff. There was a 50% decrease in alcohol-related EMS calls and ED visits in the six hours following kickoff, despite the availability of alcohol for sale inside the stadium. As a result, we reject our hypothesis that the increased access to in-stadium alcohol would lead to more incidents. The reason for this decrease is unclear, but it is possible that fans drank less at tailgate parties knowing they could continue to consume alcohol once the game started. Yet long lines and a two-beverage limit at stadium concessions likely kept most patrons from consuming excessively.

Table 2. Odds of an emergency medical services call being alcohol related by patient and game characteristics, college football game days, 2019 + 2021.

	Odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Alcohol sales		
All games		
No alcohol sales	1.0 (ref)	1.0 (ref)
(+) alcohol sales	0.73 (0.54-0.98)	0.83 (0.48-1.42)
Home games only		
No alcohol sales	1.0 (ref)	1.0 (ref)
(+) alcohol sales	0.66 (0.47-0.93)	0.54 (0.15-2.03)
Patient characteristics		
Age		
≤17	0.23 (0.06-0.82)	0.35 (0.09-1.38)
18-20	8.72 (4.38-17.4)	7.32 (3.22-16.68)
21-30	3.52 (1.88-6.6)	3.06 (1.48-6.28)
31-40	1.07 (0.54-2.11)	1.16 (0.54-2.51)
41-50	1.0 (ref)	1.0 (ref)
51-60	1.59 (0.78-3.24)	1.91 (0.84-4.35)
61+	0.33 (0.17-0.65)	0.49 (0.23-1.03)
Gender		
Male	1.89 (1.40-2.56)	1.78 (1.20-2.63)
Female	1.0 (ref)	1.0 (ref)
Game characteristics		
Kickoff time		
Morning	1.0 (ref)	1.0 (ref)
Afternoon	1.12 (0.78-1.60)	1.52 (0.75-3.05)
Evening	1.93 (1.27-2.93)	2.02 (1.06-3.85)
Location		
Home	1.77 (1.26-2.49)	1.18 (0.65-2.16)
Away	1.0 (ref)	1.0 (ref)
Victory		
Yes	0.68 (0.48-0.95)	0.75 (0.51-1.03)
No	1.0 (ref)	1.0 (ref)

*Adjusted odds ratios obtained via multivariable logistic regression model.
CI, confidence interval; *ref,* reference.

Previous studies showed that game characteristics, such as later kickoff times, higher opponent rankings, and in-state or conference rivalry games, were associated with increased numbers of alcohol-related ejections.[14] This suggests that there is a link between the importance of a game and misconduct/unhealthy behavior. Interestingly, our data demonstrated no such association between game characteristics and alcohol-related ED visits. Perhaps the factors of long lines and two-beverage limits at the stadium modulated the influence of game characteristics on the negative effects of alcohol consumption. Investigation of both the social and public health effects of in-stadium alcohol sales would be an interesting avenue for a future study to further evaluate this contrast in results.

Unsurprisingly, patient factors that were significantly associated with alcohol-related ED visits included male gender, age 18-30, leaving against medical advice/eloping, and discharge to police custody. This is consistent with prior data showing that men between the ages of 21-29 years are most likely to be intoxicated at college football games.[8,10] While the demographics of all those attending sporting events should be included for public awareness campaigns on responsible alcohol consumption, special care should be taken by universities in conjunction with public health experts to target this particular demographic. Given the recent increase in alcohol-related ED visits among college students in general, it is important that steps are taken to reduce the morbidity

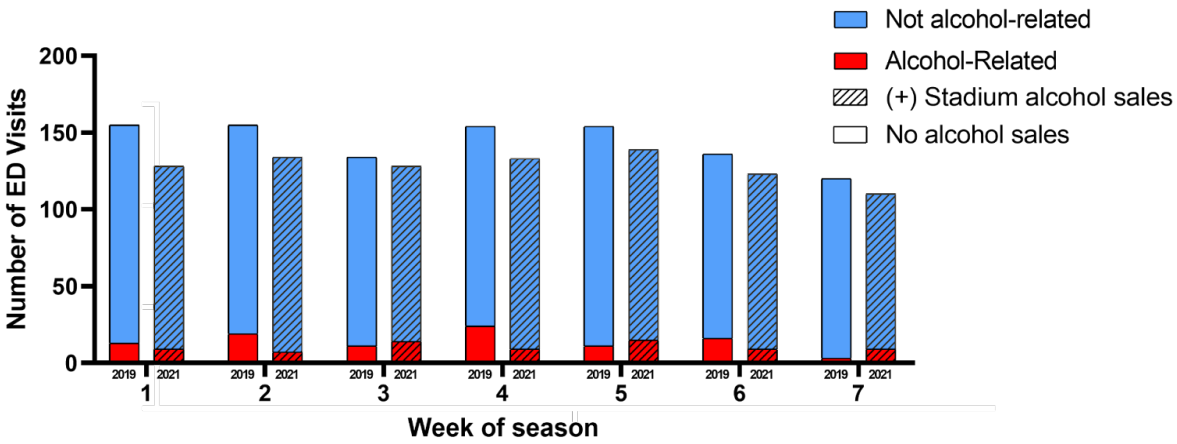

Figure 2. Number of emergency department (ED) visits on home game days, 2019 and 2021 seasons.

Table 3. Odds of an emergency department visit being alcohol-related by patient and game characteristics, college football game days, 2019 + 2021

	Odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Alcohol sales		
All games		
No alcohol sales	1.0 (ref)	1.0 (ref)
(+) alcohol sales	0.87 (0.67-1.13)	0.98 (0.70-1.38)
Home games only		
No alcohol sales	1.0 (ref)	1.0 (ref)
(+) alcohol sales	0.82 (0.60-1.13)	0.54 (0.28-1.03)
Visit 0-6 hours after kickoff, home only		
No alcohol sales	1.0 (ref)	1.0 (ref)
(+) alcohol sales	0.55 (0.32-0.97)	0.40 (0.15-1.09)
Patient characteristics		
Age		
≤17	0.04 (0.01-0.18)	0.04 (0.01-0.16)
18-20	4.35 (2.68-7.07)	3.95 (2.38-6.56)
21-30	2.09 (1.31-3.33)	2.06 (1.27-3.34)
31-40	1.15 (0.69-1.92)	1.02 (0.60-1.74)
41-50	1.0 (ref)	1.0 (ref)
51-60	0.93 (0.54-1.62)	0.87 (0.49-1.53)
61+	0.20 (0.10-0.40)	0.20 (0.10-0.40)
Sex		
Male	2.44 (1.84-3.23)	2.71 (2.00-3.66)
Female	1.0 (ref)	1.0 (ref)
Game characteristics		
Kick off time		
Morning	1.0 (ref)	1.0 (ref)
Afternoon	0.92 (0.69-1.24)	1.20 (0.81-1.78)
Evening	1.05 (0.73-1.51)	1.71 (1.08-2.71)

*Adjusted odds ratios obtained via multivariable logistic regression model.
CI, confidence interval; *ref,* reference.

Table 3. Continued.

	Odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Location		
Home	1.13 (0.86-1.49)	1.23 (0.90-1.68)
Away	1.0 (ref)	1.0 (ref)
Victory		
Yes	0.77 (0.58-1.03)	0.73 (0.51-1.03)
No	1.0 (ref)	1.0 (ref)

*Adjusted odds ratios obtained via multivariable logistic regression model.
CI, confidence interval; *ref,* reference.

associated with high-risk alcohol consumption at mass-gathering events; and young males contribute significantly to that morbidity.[15]

The policy implications of this data are important for university administrators. Considering increasing costs for athletic departments across the country, many universities are seeking additional revenue sources. Our data suggests that in-stadium alcohol sales could potentially be a revenue source without worsening negative public health consequences that are classically associated with alcohol consumption at mass-gathering events. These results also indicate that, as has been found in prior research, tailgating may contribute more to excess alcohol consumption than in-stadium alcohol sales.[16] Thus, universities should continue to evaluate implementation of policies that would restrict alcohol consumption at tailgates as a potential route for reducing the social and public health consequences of alcohol-related risky behavior.

From a public health perspective, our study does not suggest that in-stadium alcohol sales increase the burden on local EDs and EMS agencies. Contrary to the assumption that implementing alcohol sales in mass- gathering venues will require additional EMS, medical, and police resources, it is possible that responsibly managed sales may lessen the public health burden while providing a financial benefit to the institution.

LIMITATIONS

There are several limitations of this study. One includes the relatively limited sample size. While there was an abundance of EMS calls and ED visits within the dates studied, it will be important to analyze longitudinal trends, as was done over a three-year period in Barry's 2019 study.[11] Another limitation of our study is the effect of the COVID-19 pandemic. While 2020 was excluded due to the effects of the pandemic, it is possible that the 2021 data was also affected by the personal and institutional responses to the pandemic. Mask mandates were still in place, and some patrons were probably less likely to attend and consume alcohol at mass-gathering events than in prior years. However, it is important to note that there was no significant difference in overall attendance at the study site between 2019 and 2021.

It is also possible that some patients were missed by collecting only data from one ED, as the study site is in a town with two hospitals. However, the data was collected from the ED immediately adjacent to the stadium, which likely sees most if not all of the ED presentations from people attending the football games. Regardless, the EMS data was collected county-wide and, therefore, would include transports of patients taken to both EDs.

CONCLUSION

This study represents a novel contribution to the currently limited data on the public health effects of the implementation of alcohol sales inside large, college football stadiums. There is significant morbidity associated with mass-gathering events, which is only exacerbated when alcohol becomes involved. As more schools join the trend of starting in-stadium alcohol sales, it will be increasingly important to evaluate the public health and social consequences of these policy changes. Our data suggests that there is no significant increase in the number of alcohol-related emergencies after one university's implementation of alcohol sales. We intend to continue to collect local data annually to better inform our understanding of the risks and benefits associated with in-stadium alcohol sales in college football.

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"That Line Just Kept Moving": Motivations and Experiences of People Who Use Methamphetamine

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Introduction: Methamphetamine use is on the rise with increasing emergency department (ED) visits, behavioral health crises, and deaths associated with use and overdose. Emergency clinicians describe methamphetamine use as a significant problem with high resource utilization and violence against staff, but little is known about the patient's perspective. In this study our objective was to identify the motivations for initiation and continued methamphetamine use among people who use methamphetamine and their experiences in the ED to guide future ED-based approaches.

Methods: This was a qualitative study of adults residing in the state of Washington in 2020, who used methamphetamine in the prior 30 days, met criteria for moderate- to high-risk use, reported recently receiving care in the ED, and had phone access. Twenty individuals were recruited to complete a brief survey and semi-structured interview, which was recorded and transcribed prior to being coded. Modified grounded theory guided the analysis, and the interview guide and codebook were iteratively refined. Three investigators coded the interviews until consensus was reached. Data was collected until thematic saturation.

Results: Participants described a shifting line that separates the positive attributes from the negative consequences of using methamphetamine. Many initially used methamphetamine to enhance social interactions, combat boredom, and escape difficult circumstances by numbing the senses. However, continued use regularly led to isolation, ED visits for the medical and psychological sequelae of methamphetamine use, and engagement in increasingly risky behaviors. Because of their overwhelmingly frustrating experiences in the past, interviewees anticipated difficult interactions with healthcare clinicians, leading to combativeness in the ED, avoidance of the ED at all costs, and downstream medical complications. Participants desired a non-judgmental conversation and linkage to outpatient social resources and addiction treatment.

Conclusion: Methamphetamine use can lead patients to seek care in the ED, where they often feel stigmatized and are provided little assistance. Emergency clinicians should acknowledge addiction as a chronic condition, address acute medical and psychiatric symptoms adequately, and provide positive connections to addiction and medical resources. Future work should incorporate the perspectives of people who use methamphetamine into ED-based programs and interventions. [West J Emerg Med. 2023;24(2)218–227.]

INTRODUCTION

Methamphetamine use is on the rise nationwide[1] with an increasing number of emergency department (ED) visits,[2,3] behavioral health crises,[4-7] and deaths associated with use and overdose.[8] Racial inequities related to methamphetamine use are also increasing, with the highest prevalence of methamphetamine use[8] and the greatest increases in overdose deaths among American Indians/Alaska Natives. Non-injection methamphetamine use increased 10-fold among Blacks, a much steeper increase than that among White or Hispanic populations.[9]

Methamphetamine is a leading cause of substance-related ED visits.[10,11] The reasons for seeking ED care when using methamphetamine varies with patients requiring anything from medical evaluation for chest pain to sedation and psychiatric evaluation for agitation and psychosis.[12] In some areas, behavioral crises related to methamphetamine use account for half of psychiatric emergency services visits.[13] Additionally, patients who inject drugs, such as methamphetamine, seek ED care for injection-related medical complications.[2] Emergency department visits related to methamphetamine are also likely to involve trauma and/or interactions with law enforcement officers.[14,15] Along with the increase in methamphetamine-related ED visits for medical and psychiatric reasons, emergency clinicians describe methamphetamine use as a significant problem with high resource utilization and risk of violence against staff.[16,17]

There is limited literature examining the perspectives of people who use methamphetamine on their health, limiting opportunities to provide care based on patients' experiences. Among people who use methamphetamine at syringe-access programs across the state of Washington, many were interested in reducing or stopping their use[18] and wanted assistance addressing their medical and social needs through counseling, treatment, and care navigation.[19] However, there are no known studies exploring the ED experience of people who use methamphetamine.

Given the increasing prevalence of methamphetamine use and the increasing number of ED visits related to methamphetamine use disorder, it is imperative that EDs consider the best way to serve this population. For patients with opioid use disorder (OUD), EDs have expanded lifesaving buprenorphine prescribing and take-home naloxone programs nationwide,[20,21] activities that undoubtedly have improved the care for patients with OUD.[22-24] In contrast, there is currently a paucity of pharmacotherapy, psychosocial interventions, and harm reduction strategies targeting patients with methamphetamine use disorder. In this study our primary objective was to identify the motivations of people who use methamphetamine and their experiences in the ED. Secondary objectives were to inform key stakeholders, address stigmatizing behavior in healthcare settings, and guide future ED-based approaches.

Population Health Research Capsule

What do we already know about this issue?
Methamphetamine use is rising with more emergency department visits, behavioral health crises, and deaths associated with use and overdose.

What was the research question?
What are the motivations of people who use methamphetamine and their experiences in the ED?

What was the major finding of the study?
Fifty percent of participants reported that their 'main drug' was methamphetamine while 15% preferred methamphetamine and heroin, suggesting that polysubstance use is common.

How does this improve population health?
Emergency physicians should recognize the complex motivations for methamphetamine use and provide tools to promote patient wellbeing through trauma-informed care.

METHODS

Study Design and Setting

From April–September 2020, we administered close-ended questionnaires and conducted semi-structured interviews with adults residing in the state of Washington who were at moderate to high risk for methamphetamine use disorder, had presented to an ED within the prior three months, and had access to a phone. The study was approved by the University of Washington Institutional Review Board, and a Certificate of Confidentiality was obtained from the National Institutes of Health.

Selection of Participants

Participants were recruited through convenience and snowball sampling. Flyers were sent to community substance use treatment clinics, peer support groups within Seattle, WA, supportive housing facilities, office-based opioid treatment programs, opioid treatment programs, and syringe-access program locations. Interested people called our study phone and were screened for eligibility by a trained research assistant (RA). Inclusion criteria included residence in the state of Washington, access to a phone, self-reported ED visit in the prior three months, methamphetamine use in the prior 30 days, and National Institute of Drug Abuse (NIDA)-modified Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) score consistent with moderate or high risk for methamphetamine use disorder.[25]

Those eligible and interested in completing the study next provided verbal informed consent and completed a baseline survey by phone. The study RA directly entered the participant answers into a database using REDCap[26] electronic data capture tools hosted at the University of Washington. All participants who completed the survey received a $5 gift card. Participants were then invited to be interviewed. We obtained survey data from 25 participants and completed semi-structured interviews with 20 of these participants. The 20 individuals who completed the semi-structured interview provided verbal consent, completed audio recorded interviews over the phone, and received $25 gift cards. After completing an initial set of 10 interviews, we performed purposive sampling of participants who were eligible and completed the baseline survey based upon gender and race for the remaining interview participants to include more diverse perspectives.

Measurements

During the survey, participants were asked how often they had used methamphetamine in the prior 30 days before undergoing the NIDA-modified ASSIST[25] to determine risk for methamphetamine use disorder. Participants were next asked to identify their "main drug" to identify their drug of choice. Participants were also asked single-items questions on lifetime intentional fentanyl use and lifetime intentional GHB use. Validated single-item questions about tobacco, vaping, and alcohol were asked. We used the Patient Health Questionnaire-2[27] and the Generalized Anxiety Disorder-2[28] to screen for depression and generalized anxiety disorder in the prior two weeks, respectively. The human immunodeficiency virus (HIV) Risk Behavior Survey was used to determine behaviors related to injection, as well as current HIV and hepatitis C virus status. Demographic information, including age, gender, employment, and housing status, were collected. Qualitative semi-structured interviews focused on methamphetamine use, ranging from the causes behind their initial use to current use patterns, as well as on ED experiences, focusing on the patient's last ED visit related to methamphetamine use, their experiences seeking and accessing care, and their thoughts regarding how the ED could meet their needs. The interview guide was refined iteratively, and the final guide is included as an appendix.

Analysis

Using descriptive statistics, we analyzed the survey results for participants who completed the survey and the semi-structured interview. The quantitative analysis was restricted to the 20 participants who completed both the survey and the interview. Semi-structured interviews using a standardized interview guide were recorded, transcribed, deidentified, and uploaded to the qualitative data management software Dedoose (SocioCultural Research Consultants, LLC, Manhattan Beach, CA). We used a modified grounded theory framework[29,30] to continuously collect and analyze the qualitative data. The grounded theory framework[29,30] allows the results to emerge from the data without a preconceived hypothesis. Therefore, coding of the manuscripts proceeded in an iterative fashion allowing data and codes from the initial manuscripts to inform the results codebook.

Specifically, we conducted three initial interviews with an interviewer (LH) who had experience conducting semi-structured interviews and working with the target population. After these initial interviews, three members of the research staff (LH, SM, AZ) each independently reviewed two transcripts and inductively developed and applied codes to the transcript.[31] This process iteratively refined the codebook. These members and the principal investigator (LW) then met as a group until consensus was achieved on the codebook, with LW as the arbitrator. Finally, subsequent semi-structured interviews were conducted by the same trained interviewer (LH) until thematic saturation was reached.

RESULTS

Quantitative Results

Of the 25 participants who completed the survey, we interviewed 20 adults who met inclusion criteria (Tables 1 and 2). The mean age of our participants was 41.5 years (SD 8.7 years), and most participants were White cisgender men. All participants reported experiencing homelessness at some point in

Table 1. Demographics, substance use characteristics, and medical characteristics of interviewees.

	N=20 (%)
Demographics	
Age (mean)	41.5+/-8.7
Female	6 (30)
Male	11 (55)
Other gender	3 (15)
Race/ethnicity	
White	12 (60)
Black	6 (30)
Hispanic/Latinx	4 (20)
Two or more races	3 (15)
Prefers not to answer	1 (5)
Currently experiencing homelessness	8 (40)
Unemployed	13 (65)
Substance use characteristics	
Non-methamphetamine substance use in the prior 30 days	
Cigarettes or e-cigarettes	15 (75)
Alcohol	10 (50)
Heroin	9(45)

PHQ-2, Patient Health Questionnaire-2; *GAD*, General Anxiety Disorder scale; *HIV*, human immunodeficiency virus; *HCV*, hepatitis C virus. *GHB,* gamma hydroxy butyrate

Table 1 Continued. Demographics, substance use characteristics, and medical characteristics of interviewees.

Substance Use Characteristics	
Non-methamphetamine substance use in the prior 30 days	
Lifetime intentional use of fentanyl	3 (15)
Lifetime intentional use of GHB	10 (50)
Injected any drug more than once per day in the prior month	8 (40)
Lifetime opioid overdose	6 (30)
Depression in last two weeks (PHQ-2 >=3)	15 (75)
Anxiety in past two weeks (GAD>=3)	18 (90)
HIV + (sample size is n=19)	3 (16)
HCV +	4 (20)

PHQ-2, Patient Health Questionnaire-2; *GAD*, General Anxiety Disorder scale; *HIV*, human immunodeficiency virus; *HCV*, hepatitis C virus. *GHB,* gamma hydroxy butyrate

Table 2. Methamphetamine use characteristics of interviewees.

	N=20 (%)
Methamphetamine use in the past 30 days	20 (100)
Injected methamphetamine in the last 30 days	13 (65)
Self-reported "main drug"	
Methamphetamine by itself	10 (50)
Methamphetamine combined with:	8 (40)
Heroin	3 (15)
Alcohol	1 (5)
Cannabis	2 (10)
Cocaine	1 (5)
GHB	1 (5)
Other main drug	2 (10)
High risk for methamphetamine use disorder (NM-ASSIST >= 27)	19 (95)
Preferred method of using methamphetamine	
Smoking	11 (55)
Injecting	9 (45)
Experiences using methamphetamine	
In the last 12 months, have you ever felt like you were having a heart attack, stroke, or seizure while on meth? (yes)	9 (45)
In the last 12 months, have you ever had a time when you felt like you were losing your mind, manic, or psychotic while on meth? (yes)	14 (70)
In the last 12 months, have you been to an emergency room because of medical or psychiatric problems related to meth? (yes)	13 (65)

NM-ASSIST, National Institute on Drug Abuse modified Alcohol, Smoking and Substance. Involvement Screening Test. *GHB,* gamma hydroxy butyrate

their lifetime while 40% were unstably housed at the time of the interview. Ninety percent were unemployed. Many participants reported current polysubstance use. Among this sample of 20 people who reported currently using methamphetamine, 10 (50%) reported that methamphetamine was their drug of choice, while 45% reported methamphetamine combined with something else to be their preferred drug. Sixty-five percent had injected methamphetamine in the prior month, and 55% reported that their main route of administration was smoking. Thirty percent had visited the ED because of methamphetamine use in the prior 30 days. Most respondents noted physical and/or psychiatric symptoms associated with methamphetamine overdose, or "overamping," in the prior 12 months.

Qualitative Results

Our study's major theoretical contribution is that participants described a shifting line that separates the positive attributes from the negative consequences of using methamphetamine. This was best summarized by one individual, who explained: "I kept drawing lines of delineation. . . .It was just going to be when I was hooking up, and then it was just going to be on weekends. Then, it was just going to be not on workdays. And then it was going to be I was never going to inject. That line just kept moving." This line also represents interviewees' complex, occasionally paradoxical, and often shifting experiences with methamphetamine, including enhancing function while also inducing crippling paranoia, fostering friendship while also leading to unequal relationships, and addressing untreated trauma while also exacerbating it. Several themes straddled this line: 1) hypervigilance and overamping; (2) socialization and isolation; (3) treatment and withdrawal; and (4) experiences in the ED.

Hypervigilance and Overamping

Many interviewees reported initially using methamphetamine to enhance their function, whether it was cleaning, working, or studying, and to provide protection in harsh conditions like homelessness. However, this hypervigilance often led to "overamping" when a participant might have felt that they were overdosing, "paranoid," and "exhausted" (Table 3).

Socialization and Isolation

Participants described how methamphetamine originally improved their social interactions. They frequently started using with friends in social settings or to enhance sex. However, continued use regularly led to isolation and "stopping participation in life." Individuals experiencing methamphetamine-induced paranoia felt uncomfortable around others, and repeated bingeing (ie, multiple days of consecutive use) often contributed to losing family, friends, jobs, property, and "personality." Others recounted how individuals capitalized on their drug use, preyed on their vulnerabilities, and fostered unequal relationships (Table 4).

Treatment and Withdrawal

Many interviewees used methamphetamine to self-

Table 3. Interviewee experiences that describe hypervigilance and overdosing (overamping).

Hypervigilance	
Enhanced functioning	"It was all really to get through college, and I got my degree. It helped me stay up to study for exams." (#40) "With the meth I'm functional. [Without it] I might miss being able to make a list of five things to do and actually accomplishing four or five of them." (#46)
Provide protection	"Being hypervigilant also puts me in a place where I don't put myself into situations that I can be jailed or fucked up by cops." (#25) "I wanted to be aware and coherent of what was going on around me. I didn't like the nodding and falling just anywhere." (#40)
Overamping	
Paranoia	"Lots of paranoia is involved and just confusion, like I get caught in a loop and I can't stop doing, digging for something, trying to fix something. I just get stuck on a path that I can't stop doing." (#7)
Exhausted	"We don't recognize where we're at and recognize where our limits are. We don't sleep, we don't eat for days. We don't really recognize that our bodies haven't rested." (#4)

Table 4. Interviewee experiences that describe socialization and isolation.

Socialization	
Friendship	"There was a long period of time it was actually fairly fun. . . . There were lots of social circles that we'd use and have fun, but that quickly faded." (#7) "The social aspect of it got me doing it again. And shooting is just a fun way to do it compared with smoking for me, so other people got me back into it." (#29)
Sexual augmentation	"Sex would be the trigger for the longest time. . . . It was like a whole different animal, the intensity, the rush, the sexual feelings related to it are totally different." (#7) "When you're with someone that's not on it and you are really, really on it, you just don't have like the same goals in mind or just the same urgency to get done what you want to get done." (#33)
Isolation	
Uncomfortable around others	"Meth is a drug that causes you to socially isolate and social distance. People are paranoid." (#4)
Loss	"I only participate in getting high. I've got a whole bunch other things I could participate with. I got kids and grandkids and family. . . . I don't want to do nothing but get high." (#7) "I lost all my friends, all my surroundings around me, all my coworkers. I lost communication with relatives and people that I had in my life. . . . I don't know why we even continue criminalizing [drugs] because I'm already a prisoner." (#41)
Unequal relationships	"Living on the road, being homeless off and on, and now it's like total dependency, so there are places I'll get housed at because like a guy or an older guy would help me out for a little bit . . . but then they're very manipulative." (#26)

medicate, stabilizing their mental health, numbing their senses to escape difficult circumstances, and counteracting the negative effects of other drugs. However, the increasing need to use methamphetamine to combat withdrawal symptoms led participants to "hustle" and engage in increasingly risky behaviors, like sex work, to obtain the resources to purchase enough to avoid feeling sick (Table 5).

Experiences in the Emergency Department

Interviewees often experience stigmatizing healthcare interactions because of their methamphetamine use. Many described undertreatment of pain, difficulty obtaining intravenous access, unhelpful referrals, and traumatizing experiences, particularly while intoxicated with methamphetamine. Because of these overwhelmingly frustrating experiences, participants anticipated difficult interactions with healthcare clinicians, frequently leading to combativeness, avoidance of the ED, and downstream medical complications (Table 6). Nevertheless, methamphetamine use often drives patients to EDs, where they would like to receive resources, shelter, and treatment (Table 7).

DISCUSSION

Experiences with overamping, isolation, and withdrawal mirror the current literature describing the negative consequences of use,[32] but participants also explored how methamphetamine can enhance function and strengthen relationships. This "moving" line between methamphetamine's risks and benefits highlights the need for nuanced conversations about substance use in medical settings. People who use methamphetamine often want to reduce their use, but their motivation and goals are fluid.[19]

Table 5. Interviewee experiences that describe treatment and withdrawal.

Treatment	
Mental health	"It maybe relates to a specific disorder . . . maybe like ADD or ADHD . . . I want to say that using meth . . . putting the hyperactive mind with the hyperactive drug to stimulate kind of almost reduces . . . that hyperactivity." (#19) "It's more than just for fun because it stabilizes my mood disorder." (#40)
Escape	"I had lost my job, my partner. . . . We were in a kind of a low and violent point, and it was an escape. . . . I really think the whole reason I started was self-medicating." (#15) "Definitely coping and also helps me drown out . . . Memories or emotions. . . . It's a ritual routine now." (#26)
Negative effects of other drugs	"You get the meth rush over the black. . . It goes back and forth, like you'll feel the numbing effect from heroin, the slow effect, and then it'll switch over to the meth high, the racy, euphoric kind of feeling that you get from meth." (#29)
Withdrawal	
Symptoms	"Now, unfortunately, when I do stop, it makes me horribly sick. . . I don't really have the luxury of just choosing not to do it anymore." (#12)
Hustling	"A typical day, like I wake up, I do a shot of heroin, smoke some meth, go hustle, smoke some more meth, do another shot, go hustle, and do the same thing, then go to sleep." (#10) "Usually, I'll panhandle most days and get enough money to maintain not being sick throughout the day. . . . My day revolves around having the shots to do." (#29) "I have kind of a boyfriend, and he does leave meth for me when he leaves." (#46)

Table 6. Interviewees' negative experiences in the emergency department.

Stigmatizing care	"As soon as they find out that, yes, it was 100 percent drug-related, I get treated differently." (#29) "Maybe after some work with this population, maybe people give some sort of a numbness . . . like they don't see you are regular [person] or they see [you as], 'She's already overdosed and so why should we care about you?'" (#41)
Undertreatment of pain	"We'll go through these procedures with absolutely no pain med at all. . . . And they feel like I'm asking to be sent home with pain meds, [thinking] I'd obviously abuse them. So I never ask to bring any home." (#29)
Difficulty obtain IV access	"I'm terrified of needles when someone else is doing it, and, then, with not having very many veins to poke . . . They have to get an ultrasound, so it's a really big ordeal when I go [to] a hospital and have to have blood taken from me." (#12)
Unhelpful referrals	"The doctor said I need to follow up with this [a community help line]. [But I'm thinking,] 'How can I follow up with this if you're not giving me no more information that I already had before I came in here?'" (#46)
Traumatizing experiences	"When I was walking to the emergency room, fire trucks and shit like that . . . fucking irritate my goddamn brain cells. I come out and certain sound effects and shit like that, paranoia. (#34) "I don't know how many times I've gone to the hospital, scared out of my mind, and I was high, and they treated me unfairly because I was high." (#39)
Combativeness	"And then they find out that I'm an addict, and it all goes downhill. . . . Maybe I get like a little bit of like a bad attitude. . . If I know that this person's going to be mean to me because everybody else has been, then I'm going to be mean initially anyway." (#10)

IV, intravenous.

Table 7. Interviewees' positive experiences in the emergency department.

Resources	"Give them some resources, whether or not they said yes or no." (#26) "About places to get into rehab, places for wound care, like a place to heal up afterwards if you're homeless. Like maybe the needle exchange. Just like information of things that addicts and homeless people could really use." (#43)
Shelter	"When I have done treatment, it was when I was homeless, so after the treatment [I'd] get released right back to the same situation. No place to go, no home. You can refer me to all these outpatient places and tell me I need X amount of meetings, but once I go to my classes and go to my meeting, now where do I go?" (#46)
Treatment	"I think ERs are probably overwhelmed, and they don't need a bunch of people coming in saying, 'Where can I go to rehab?' But if they don't have anywhere else to go . . ." (#15) "The one thing that I've found that helped me when I was trying to quit was my doctor prescribed me methylphenidate . . . And I don't understand why that's not utilized more often because for opiates they use like Suboxone and methadone." (#20)

Emergency physicians should recognize the complexity of patients' motivations and provide tools to promote wellbeing. They should aspire to provide trauma-informed care[33] to those who use drugs by better understanding each patient's unique history and recognizing the health effects of stigma.[34]

Participants frequently acknowledged the dangers of methamphetamine and wanted help but purposefully avoided medical care because of the perceived discrimination from healthcare staff. Many cited disrespectful interactions, undertreatment of pain, difficulty obtaining intravenous access, unhelpful referrals, and traumatic experiences in the ED related to their methamphetamine use. Interviewees hoped for, but rarely encountered, clinicians who acknowledged addiction as a chronic condition, addressed symptoms adequately, and provided positive connections to outpatient resources. This stigma experienced by people who use methamphetamine mirrors stigma experienced by people who use opioids.[35] Moreover, many methamphetamine-related ED visits for behavioral health concerns include chemical and/or physical restraints, which can feel dehumanizing to patients.

Emergency physicians can learn from community harm reductionists at syringe service programs and safe consumption sites about how to change this culture and create a protected space for people who use methamphetamine.[36] The distribution of safer use supplies, such as syringes and pipes, decreases risky behaviors and the spread of infectious diseases while promoting more collaborative medical interactions.[37-45] Because methamphetamine use is associated with high-risk sexual practices, clinicians can also consider sexually transmitted infection testing, treatment, and prevention services. Whether or not these services could be expanded to emergency care settings should be further explored.

Although not widespread, harm reduction principles have been successfully integrated as pilot programs into traditional clinical settings, which could be used as models in other environments. One hospital system created a multidisciplinary and interprofessional care conference to expand treatment options for patients with substance use disorders needing prolonged antibiotic treatment for conditions like endocarditis and osteomyelitis.[46] As part of their efforts to improve access to addiction care in emergency departments, CA Bridge, a program of the Public Health Institute in Oakland, California, has created adaptable materials on harm reduction kits, discharge instructions, strategies for hospital settings, and order sets based upon the experiences of selected clinical partners.[47-50]

Lastly, as in other published work,[51] participants expressed interest in accessing treatment and reducing their methamphetamine use. Although an effective pharmacotherapy for methamphetamine use has not yet been developed, there are several effective, yet underutilized, psychosocial treatments for methamphetamine use disorder. Contingency management[52] reinforces positive behavioral change with rewards. Examples of incentivized behaviors include abstinence, engagement in therapy sessions,[53] and harm reduction.[54] Rewards typically include prize draws in cash or gift cards of escalating value. Although contingency management can be effective on its own, it can also be paired with the community reinforcement approach,[55] which uses social, recreational, familial, and vocational reinforcers to help patients engage in non-substance-use related activities and communities, so they can find meaning in a lifestyle that does not revolve around substance use.[56] A recent meta-analysis showed that contingency management coupled with the community reinforcement approach was the only evaluated treatment associated with decreased substance use at the longest follow-up time and increased engagement in treatment for individuals with stimulant use disorder.[57] Contingency management has been successfully implemented in homeless shelters,[58] community centers,[54] primary and specialized care clinics,[59,60] and sober living arrangements.[61] Emergency physicians should consider creating referral pathways for patients who use methamphetamine in partnership with agencies providing these evidence-based interventions.

LIMITATIONS

The objective of this study was to identify the motivations of people who use methamphetamine and their experiences in the ED to guide future ED-based approaches. However, the results may only be applicable to the geographic location of the study population, which only included residents of the state of Washington. We used a convenience sampling frame to recruit participants, which may have introduced bias. Specifically, recruitment and interviews did not take place in person; therefore, this study may not have captured the voices of those with high social needs without access to a phone. Additionally, questionnaire data, including recent ED visits and substance use history, were self-reported and could not be confirmed with the patient's electronic health record or through drug testing. Lastly, the study was conducted at the beginning of the coronavirus disease 2019 pandemic, while the "stay home, stay healthy" order was in place,[62] which may have influenced participants' perceptions of their medical care.

CONCLUSION

Methamphetamine use drives patients to EDs, where they often feel stigmatized and are provided little assistance. Emergency physicians can use trauma-informed care to change this culture and create a healing space for people who use methamphetamine. They can offer ultrasound-assisted peripheral line placement and treat symptoms of overdose, withdrawal, and pain. Using harm reduction principles, EDs can provide HIV and hepatitis C testing and distribute safer use supplies. Physicians can partner with a multidisciplinary team to improve access to social services and transitions of care to addiction treatment in the community. Future work should incorporate the perspectives of people who use drugs into ED-based programs and interventions.

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Optimizing Recruitment and Retention in Substance Use Disorder Research in Emergency Departments

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Introduction: Clinical trial recruitment and retention of individuals who use substances are challenging in any setting and can be particularly difficult in emergency department (ED) settings. This article discusses strategies for optimizing recruitment and retention in substance use research conducted in EDs.

Methods: Screening, Motivational Assessment, Referral, and Treatment in Emergency Departments (SMART-ED) was a National Drug Abuse Treatment Clinical Trials Network (CTN) protocol designed to assess the impact of a brief intervention with individuals screening positive for moderate to severe problems related to use of non-alcohol, non-nicotine drugs. We implemented a multisite, randomized clinical trial at six academic EDs in the United States and leveraged a variety of methods to successfully recruit and retain study participants throughout the 12-month study course. Recruitment and retention success is attributed to appropriate site selection, leveraging technology, and gathering adequate contact information from participants at their initial study visit.

Results: The SMART-ED recruited 1,285 adult ED patients and attained follow-up rates of 88%, 86%, and 81% at the 3-, 6-, and 12-month follow-up periods, respectively. Participant retention protocols and practices were key tools in this longitudinal study that required continuous monitoring, innovation, and adaptation to ensure strategies remained culturally sensitive and context appropriate through the duration of the study.

Conclusion: Tailored strategies that consider the demographic characteristics and region of recruitment and retention are necessary for ED-based longitudinal studies involving patients with substance use disorders. [West J Emerg Med. 2023;24(2)228–235.]

INTRODUCTION

In the United States, the emergency department (ED) is an important healthcare access point, especially for underinsured and underserved populations with reduced access to other sources of care.[1] In 2016 there were an estimated 145.6 million visits to non-federal hospital EDs in the United States,[2] and a

report published in 2010 by the Substance Abuse and Mental Health Services Administration found that almost half of all ED visits were related to drug misuse or dependence.[3] Because EDs serve a high volume of individuals with substance use disorders, ED visits present opportunities for screening, brief intervention, and referral to treatment (SBIRT).[4]

There are some distinctive barriers inherent in recruiting individuals with substance use disorders. The rate of recruitment in clinical trials for addiction research is linked to location and size of the recruitment site, the target population, the inclusion and exclusion criteria, and the perceived benefit to the participant of the treatment offered.[5] The natural inclination for individuals to understate or hide highly stigmatized behaviors presents obstacles in both recruitment and data quality.[6-10] Additionally, patients may decline to participate because of a number of reasons including not feeling well, lack of interest, concerns about confidentiality, and the time-consuming nature of the study.[11-13] Obtaining a representative sample of the population of interest and agreement rates of 70% or more support generalizability of that population.[14-16]

Participant compensation is another important consideration. Participants may perceive low compensation as patronizing, while excessive payment can compromise voluntary consent.[17] Yet even though it is important to establish appropriate compensation for participation,[16] it is not the most important factor in securing enrollment.[18-19] Study staff flexibility (eg, taking breaks from study assessments for medical interventions) and rapport-building (eg, expressing compassion) are considered two of the most important determinants in successful recruitment for ED-based clinical trials.[19-25]

In medical settings, collecting data from patients with electronic devices, such as tablet or laptop computers, has proven to be an acceptable[26] and time-saving[27] method for gathering information. Allowing participants to complete behavior assessments electronically minimizes feelings of embarrassment and judgment and improves a sense of privacy compared to study staff interview methods.[28-30] Several studies suggest that electronic screening outperforms verbal screening in detecting adversity across a spectrum of potentially sensitive topics among ED patient populations. [28-30]

In addition to its role in data collection and data quality, technology has also proven useful with participant tracking in longitudinal studies. Both free and fee-based online search tools, online public records, and social networking sites are useful for locating participants.[21,31] Longitudinal ED-based research requires a variety of retention strategies including collecting adequate participant contact information; making repeated contact attempts for follow-up visit completion including in-person, phone calls, mailed letters, and web-based strategies; and allowing for flexibility in the location of follow-up completion.[32]

Although extensive research has been done on SBIRT in alcohol use disorder, much less SBIRT research has been done with other substance use disorders.[1,33-34] To address this gap, we conducted a multisite trial "Screening, Motivational Assessment, Referral, and Treatment in Emergency Departments (SMART-ED)" through the National Institute on Drug Abuse Clinical Trials Network (NIDA CTN) to compare the effectiveness of 1) a brief motivational interviewing[36] intervention; 2) screening, assessment and referral; and 3) minimal screening only in an ED sample of patients with probable SUD. Conducting multisite clinical trials with complex behavioral interventions in the ED presents numerous challenges in recruitment and retention of participants. We describe our recruitment and retention experiences and the lessons learned while conducting this ED-based, multisite SBIRT study.

Population Health Research Capsule

What do we already know about this issue?
Clinical trial recruitment and retention of individuals who use substances are challenging in any setting and can be particularly difficult in ED settings.

What was the research question?
How can we maximize recruitment and retention of individuals who use substances who are patients in the ED?

What was the major finding of the study?
Recruitment goals were met: 1,285 were enrolled in the study and the 3-, 6-, and 12-month retention rates for this study were 89%, 86%, and 81%, respectively.

How does this improve population health?
Successful recruitment and retention allow for a better understanding of how an intervention in the ED impacts current and future substance use.

METHODS

Recruitment and initial baseline assessment for the SMART-ED study took place between October 2010–February 2012 in six urban academic EDs in the US, each of which partnered with a node of the NIDA CTN (**Trial Registration** www.clinicaltrials.gov Identifier: NCT01207791).[34] Three sites were on the East Coast and one in each of the Midwest, South, and Southwest regions (Table 1).[34] Site selection criteria for this study included the following: EDs that collectively had a patient population broadly representative of the US population; an adequate

Table 1. Site characteristics.

Site regions	Trauma center designation	Annual ED visits	Urban vs rural (state)	
East Coast site 1	Level I	>100,000	Urban (MA)	Major teaching hospital (AMC)*
East Coast site 2	Level I	96,000	Urban (NY)	Major teaching hospital (AMC)*
East Coast site 3	Level I	54,000	Urban (WV)	Major teaching hospital (AMC)*
Midwest site	Level I	>75,000	Urban (OH)	Major teaching hospital (AMC)*
South site	Level I	120,000	Urban (FL)	Major teaching hospital (AMC)*
Southwest site	Level I	>80,000	Urban (NM)	Major teaching hospital (AMC)*

* Major teaching hospital or academic medical center is defined as a teaching hospital with an affiliated medical school.
ED, emergency department; *MA,* Massachusetts; *NY,* New York; *WV,* West Virginia; *OH,* Ohio; *FL,* Florida; *NM,* New Mexico; *AMC,* Academic Medical Center

number of ED patients with SUD; ED research experience and infrastructure; access to a referral network for specialty addiction treatment; and EDs with the sufficient staff and willingness to participate and implement the study protocol.

For this study our goal was to enroll 1,285 participants across sites over a nine-month period and complete follow-up visits at three, six, and 12 months post baseline.

We used tablet computers for a number of project activities: 1) to screen and collect data; 2) access the electronic health record; and 3) collect participant contact information. In addition to eliminating the need for paper forms, tablet computers allowed study staff to receive immediate notification of participant eligibility and group randomization. Study staff approached potentially eligible patients after triage. The ED tracking boards helped to locate patients. Table 2 lists the complete inclusion and exclusion criteria. Every effort was made to meet with patients in a private room, although this was often a challenge. At one site, study staff placed a partition in the corner of the waiting room and used this space to screen patients for the study.

Once they were enrolled, we collected participant contact information including 1) residential and mailing address, 2) phone number(s), 3) email address, 4) Social Security number, 5) place of employment, and 6) contact information for two "locators" (ie, persons who would know how to contact the participants during the course of the study). If they were not able to provide sufficient contact information, they were not eligible to participate (Table 2). Although Social Security numbers were gathered as a part of the form used for this study, they were not used to track participants in this study. Participants were randomly assigned to one of three cohorts: 1) brief motivational interviewing intervention; 2) screening assessment and referral; or 3) minimal screening only.

Compensation for completing the baseline and each follow-up assessment was $50 and $75, respectively. Baseline assessments took between 60-120 minutes, and follow-up assessments ranged between 90-210 minutes to complete. At a separate location from the ED, staff (who were blinded to treatment assignment) conducted follow-up assessments. Appointment cards, maps, and study contact information were provided at the initial ED baseline visit, and reminder calls were made prior to each follow-up visit.

When a participant attended their follow-up study visit, staff were required to review and update all participant contact information. If a participant did not attend their follow-up visit, staff would, in order, do the following: attempt to reach the participant by varying times of call attempts; send email and text message; mail a letter to the participant; and contact the participant's locators. If staff were unsuccessful in reaching the participant, they would conduct an internet search to try to obtain more current contact information. At one site, follow-up staff attempted to locate the participant in person at their home address. Across and within sites, there did not appear to be a single approach to locating participants and scheduling follow-ups that emerged as superior to another approach.

Follow-up staff documented all contact attempts, regardless of success, in the "Contact Log," which included date and time of attempted contact and a description and result of the attempt (Figure). Documentation allowed staff to see what type of contacts had already been attempted. Unsuccessful tracking methods and bothering a participant or locator who may have been recently contacted were not repeated. In addition to using the participant contact information provided to help locate participants for follow up, other accommodations such as meeting at a more convenient location (depending on institutional review board [IRB] rules), varying times to meet, or a phone option for conducting

Table 2. Study inclusion and exclusion criteria.

Inclusion criteria
1. Registration as a patient in the ED during study screening hours
2. Positive screen (>3) for problematic use of a non-alcohol, non-nicotine drug based on the Drug Abuse Screening Test
3. At least one day of problematic drug use (excluding alcohol or nicotine) in the past 30 days
4. Age 18 years or older
5. Adequate English proficiency
6. Ability to provide informed consent
7. Access to phone (for booster sessions)
Exclusion criteria
1. Inability to participate due to emergency treatment
2. Significant impairment of cognition or judgment rendering the person incapable of informed consent (eg, traumatic brain injury, delirium, intoxication)
3. Status as a prisoner or in police custody at the time of treatment
4. Current engagement in addiction treatment
5. Residence more than 50 miles from the location of follow-up visits
6. Inability to provide sufficient contact information (must provide at least 2 reliable locators)
7. Prior participation in the current study

Figure. Sample contact log.

Attempt	Date	Time	Description	Result
1	09/01/09	8:58 AM	Called participant's home phone number.	Left message on voicemail
2	09/02/09	2:33 PM	Sent text message to participant's cell phone number.	No response
3	09/02/09	5:22 PM	Called participant's home phone number.	Left message on voicemail
4	09/04/09	9:30 AM	Sent email to participant	Email returned, "email address not found"
5	09/04/09	10:00 AM	Sent letter to participant's home address	No response
6	09/09/09	11:33 AM	Called locator 1	Number out of service
7	09/09/09	11:35 AM	Called locator 2	Locator 2 stated that she would give the participant the message to call.
8	09/10/09	9:22 AM	Participant called	Scheduled follow-up for 09/15/2009 at 9:30 AM

follow-up were offered. Study staff also emphasized that participation in the study was voluntary.

Participant incarceration is an expected occurrence that poses challenges to completing follow-up. In anticipation of this reality, we obtained Office for Human Research Protections approval to conduct follow-up visits with participants who became incarcerated after enrollment, and the SMART-ED study sites pursued IRB approval. Ultimately, the ability of the study staff to follow up with the participant depended upon the study site's IRB regulations, type of consent obtained from the participant, and the rules of the confining correctional facility.

Another challenge to retention was the occasional participant request for withdrawal when contacted to schedule follow-up visit appointments. In such cases, we honored the request and mailed the participant a letter confirming their decision to withdraw, providing the study's contact information, reviewing the benefits of participation, and inviting them to contact the study should they change their mind.

Ongoing study staff training occurred throughout the study, emphasizing the importance of 1) recruitment study staff approaching all potentially eligible patients (post-triage) without regard to diagnosis, thus, improving the representativeness of the sample; and 2) follow-up study staff reviewing the methods for contacting participants. Additionally, weekly recruitment and retention calls with all sites provided a forum to discuss any recruitment and retention issues, clarify procedures, and troubleshoot unanticipated problems.

Over the course of the study, we made several adjustments to improve participant retention. These adjustments included decreasing assessment time at follow-up (ie, fewer assessments administered at follow-up), expanding the time windows for completing assessments, and providing incentive compensation to study staff at sites who achieved an 85% follow-up rate or higher. The original four-week time window for completing follow-up assessment (two weeks before and two weeks after the ideal follow-up date) was opened to allow a participant six weeks to complete follow-up visit (two weeks prior and four weeks post the ideal follow-up date). For example, if someone's follow-up was due on February 14, they could be seen as early as February 1 or as late as March 14 for their follow-up.

This expanded follow-up time window offered participants increased flexibility and convenience when scheduling their visits without compromising follow-up data integrity. The incentive compensation offered to study staff who achieved 85% follow-up rates or higher was in the form of a $5 gift card to a coffee shop for each staff member involved in follow-ups at that site. This amount was felt to increase team motivation and promote friendly competition across the study sites to complete follow-up visits with participants, without encouraging coercive practices or dishonest reporting.

RESULTS

Sites recruited participants for this study over a 16-month period during which a total of 20,762 patients were approached for an initial screening. Of those, 15,224 (73.3%) patients gave verbal consent to anonymously complete an electronic screening questionnaire to determine eligibility. Based on eligibility, willingness to participate, and ability to continue, 1,285 patients were enrolled in this study, on target with recruitment projections. We excluded patients who had an incomplete screen (252), fell below the cutoff score of the Drug Abuse Screening Test for problematic drug use (12,888), failed to meet inclusion criteria (64), did not complete consent (725), or withdrew prior to randomization (10). Table 3 provides an overview of study participant characteristics.

Tracking and retention occurred over a 29-month period during which staff completed 3,179 follow-up assessments. The 3-, 6-, and 12-month retention rates for this study were 89%, 86%, and 81%, respectively. Follow-up rates did not vary by group assignment (Table 4). Aside from being unreachable for follow-up, other reasons for missed follow-ups included incarceration, study withdrawal, and death.

As many as 70 contact attempts were made for a few participants before they completed a follow-up. Follow-up staff made on average 26 contact attempts per participant to schedule a follow-up appointment. Contact attempts included making phone calls to participants and locators; texting; sending letters and email messages; conducting online searches to include searching obituaries and

Table 3. Study participant characteristics.

Characteristic	Total [N (%) or mean (SD)]
Gender	
Male	898 (70)
Female	387 (30)
Mean Age, mean (SD)	36 (12)
Ethnicity	
Hispanic or Latino	305 (24)
Not Hispanic or Latino	971 (76)
Chose not to answer	9 (1)
Race	
American Indian or Alaska Native	24 (2)
Asian	8 (1)
Black or African American	440 (34)
Native Hawaiian or Pacific Islander	5 (0)
White	641 (50)
Other	66 (5)
Multiracial	63 (5)
Unknown	15 (1)
Chose not to answer	23 (2)
Education completed	
1-11y	408 (32)
GED/12y	417 (32)
Some college	338 (26)
College degree	94 (7)
Some graduate	10 (1)
Graduate degree	16 (1)
Postgraduate degree	2 (0)
Marital status	
Married	122 (9)
Remarried	1 (0)
Widowed	27 (2)
Separated	86 (7)
Divorced	158 (12)
Never married	776 (60)
Cohabitating, not married	115 (9)
Employment in past 30 days	
Full-time	244 (19)
Part-time	209 (16)
Student	84 (7)
In controlled environment	3 (0)
Retired/disability	187 (15)
Service	0
Homemaker	12 (1)
Unemployed	546 (42)

GED, General Equivalency Diploma.

Table 3. Continued.

Characteristic	Total [N (%) or mean (SD)]
Annual household income	
$0-$15,000	804 (63)
$15,001-$30,000	180 (14)
$30,001-$50,000	80 (6)
$50,001-$75,000	36 (3)
$75,001-$100,000	22 (2)
>100,000	13 (1)
Declined to answer	150 (12)
Primary substance	
Cannabis	567 (44)
Cocaine	349 (27)
"Street" opioids	218 (17)
Prescription opioids	69 (5)
Methamphetamines	49 (4)
Sedatives and sleeping pills	20 (2)
Hallucinogens	9 (1)
Prescription stimulants	3(0)

incarceration websites; visiting the participant's home; and on occasion, if approved by the local IRB, sending private messages on Facebook. Phone calls were the most common method used to contact a participant. Varying the time of calling and the days when a participant was called increased the success of reaching and scheduling follow-ups with participants.

Of the 3,176 follow-up assessments completed, 2,918 (91.8%) were in person and 261 (8.2%) over the telephone. We identified 64 participants incarcerated at some point in the follow-up period. Comprehensive study results can be found in the author MB's 2014 primary outcomes paper.[35]

DISCUSSION

The population in this study included ED patients with SUD. Retention at the three-month follow-up was 89% and remained above 80% for subsequent follow-ups. Site selection based on predetermined criteria, inclusion and exclusion criteria that included criteria that increased the likelihood of successful follow-up with participants, adequate compensation for study visits, ongoing training and monitoring of recruitment and retention efforts, effective use of technology (eg, tablet computers), and flexibility in enrollment and conducting follow-up assessments were factors considered to support successful recruitment and retention of participants. Urban sites with a large ED census of patients and availability of substance use treatment programs were also key factors in site selection for this study (Table 1). Additionally, patient population characteristics were considered for generalizability of the study (Table 3).

We chose certain inclusion and exclusion criteria to support successful follow-up with participants (Table 2). Criteria for inclusion that contributed to ease of contacting participants for follow-up included access to a phone, residence within 50 miles from the location of follow-up visits, and ability to provide sufficient contact information (required to provide at least two reliable locators). "Locators" are individuals who may have contact information for the participant if the follow-up staff are not able to reach the participant. Although the same recruitment and retention guidelines were used across study sites, the success of using these guidelines varied; methods that worked well at one site were not always effective across sites. It was important to allow sites to adapt general study guidelines that best suited their population and environment.

Staff flexibility at enrollment (eg, meeting patients when they felt well enough to complete assessments and were not busy with medical care) and follow-up (eg, completing follow-ups by phone or in the community and when convenient to the participant), was the single most likely factor to have mediated the success in recruitment and retention. We did not gather data on the participant's opinion of using tablet computers, but it is hoped that this minimized any feelings of embarrassment or perceived stigmatization in reporting sensitive drug use information. Similarly, compensation is presumed to have been acceptable as there were no complaints about compensation being too little or too much over the course of the study.

The average number of contact attempts was 26 and ranged up to 70 to reach a participant for a follow-up visit. Most commonly, participants or their locators were reached

Table 4. Follow-up rates by group assignment.

	Brief motivational interviewing intervention (N=427)	Screening, assessment and referral (N=427)	Minimal screening (N=431)
		N (%)	
Completed 3-month follow-up	375 (88)	382 (90)	382 (89)
Completed 6-month follow-up	362 (85)	370 (87)	375 (87)
Completed 12-month follow-up	338 (79)	348 (82)	357 (83)

by phone or via letters sent, but conducting online searches and using social media (ie, Facebook) to connect with participants were important access points as well. Both the amount of time and effort this intense level of follow-up entailed and the potential for participants to feel harassed or coerced to participate must be seriously considered. To ensure participants do not feel harassed or coerced, it is important to emphasize that participation is voluntary. Additionally, documentation of contact attempts ensures that participants who have refused to participate are not contacted again and contact methods that have been unsuccessful are not repeated. The level of effort to contact participants is time-consuming, and it is important to appropriately plan for this. Likewise, thoughtful and strategic outreach to enrolled patients requires careful internal documentation and communication within the follow-up team, also requiring time and effort.

For future research in EDs we would recommend using wireless internet data cards rather than relying on wireless connections to the ED network. Losing internet connection became a point of frustration for both participants and enrollment study staff conducting interviews as they would sometimes lose data and be forced to repeat parts of the baseline assessment. A wireless internet data card allows users to access online information anytime and anywhere without getting disconnected from the network.

Obtaining participant consent upfront for texting, emailing, and searching for participants through publicly available data including social media networks such as Facebook is recommended. We implemented this midway through the study, and some study sites had difficulty in gaining permission from their IRBs to use these resources without participant consent. We would also recommend seeking IRB approval and participant consent to continue working with enrolled study participants who might become incarcerated during the study.

LIMITATIONS

Allowing follow-ups to occur outside the target follow-up date may have inflated retention results slightly, but because these windows were well-defined and narrow, the impact on data was minimal and we feel the benefit to follow-up rates and data collection justifies the approach.

CONCLUSION

Consistent with the research, we found that recruitment of ED patients with substance use disorder and retention of these participants in a longitudinal study required a multifaceted process. We found that certain methods for recruitment and retention were useful across sites (eg, exclusion criteria, consent for contact through social media, IRB approval of procedures to retain incarcerated patients), but it was also important to consider the location of a study site in tailoring and developing additional strategies."

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Experiences with Medications for Addiction Treatment Among Emergency Department Patients with Opioid Use Disorder

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Introduction: Medications for addiction treatment (MAT) are the evidence-based standard of care for treatment of opioid use disorder (OUD), but stigma continues to surround their use. We conducted an exploratory study to characterize perceptions of different types of MAT among people who use drugs.

Methods: We conducted this qualitative study in adults with a history of non-medical opioid use who presented to an emergency department for complications of OUD. A semi-structured interview that explored knowledge, perceptions, and attitudes toward MAT was administered, and applied thematic analysis conducted.

Results: We enrolled 20 adults. All participants had prior experience with MAT. Among participants indicating a preferred treatment modality, buprenorphine was the commonly favored agent. Previous experience with prolonged withdrawal symptoms upon MAT discontinuation and the perception of "trading one drug for another" were common reasons for reluctance to engage in agonist or partial-agonist therapy. While some participants preferred treatment with naltrexone, others were unwilling to initiate antagonist therapy due to fear of precipitated withdrawal. Most participants strongly considered the aversive nature of MAT discontinuation as a barrier to initiating treatment. Participants overall viewed MAT positively, but many had strong preferences for a particular agent.

Conclusion: The anticipation of withdrawal symptoms during initiation and cessation of treatment affected willingness to engage in a specific therapy. Future educational materials for people who use drugs may focus on comparisons of respective benefits and drawbacks of agonists, partial agonists, and antagonists. Emergency clinicians must be prepared to answer questions about MAT discontinuation to effectively engage patients with OUD. [West J Emerg Med. 2023;24(2)236–242.]

INTRODUCTION

Non-fatal opioid overdoses outnumber fatal overdoses by 20 to 1.[1] Most individuals who receive naloxone from first responders are transported to an emergency department (ED).[2] In 2017, more than 965,000 patients were treated in EDs after non-fatal opioid overdoses.[3] Thus, the ED visit following an opioid overdose represents a critical opportunity for healthcare workers to offer evidence-based interventions for opioid use disorder (OUD), including medications for addiction treatment (MAT), to a high-risk and vulnerable population.[4,5] Initiating

MAT in the ED has been shown to improve retention in treatment for OUD at 30 days.[6] Moreover, treatment of OUD with methadone or buprenorphine in the year following a non-fatal overdose is associated with marked reductions in all-cause and opioid-related mortality.[7]

Given the fulminant course of these patients – 5% will die within the year – opioid agonist or partial-agonist treatment from the ED should be offered to all patients who present after non-fatal overdose.[8] Yet few people who use drugs receive MAT despite increases in availability of this treatment.[9] Experts have postulated that key barriers are stigma, logistical issues, clinician lack of training on OUD treatment, and gaps in patients' knowledge regarding treatment options.[10] However, knowledge and attitudes of ED patients toward MAT have not been adequately elucidated. We sought to improve understanding of patient attitudes, misconceptions, and barriers to MAT to facilitate engagement with MAT from the ED. Specifically, we used a semi-structured interview to assess the following: 1) familiarity with MAT; 2) attitudes toward and experience with methadone, buprenorphine, naltrexone, and abstinence-based treatment; 3) experiences with withdrawal symptoms; and 4) treatment acceptability.

Population Health Research Capsule

What do we already know about this issue?
Medications for addiction treatment (MAT) comprise the evidence-based treatment of opioid use disorder, yet stigma and barriers to access limit their use.

What was the research question?
We sought to improve understanding of emergency department (ED) patient attitudes, misconceptions, and barriers to MAT.

What was the major finding of the study?
Participants viewed MAT positively, yet acceptance was curbed by anticipated withdrawal upon cessation.

How does this improve population health?
By addressing concerns around discontinuation of MAT and educating patients on its benefits, we can increase engagement in MAT among ED patients.

METHODS

This was a qualitative study of adult patients who presented to an ED with an opioid-related chief complaint. This study was approved by the University of Massachusetts Chan Medical School Institutional Review Board, employed an exploratory qualitative design, was not hypothesis-driven, and was not pre-registered in a publicly available platform.

Setting

Massachusetts is the most populous state in the New England region of the United States (US). Its population of 6.9 million has been disproportionately affected by the opioid epidemic, with an overdose mortality rate of 29.3 per 100,000 in 2018, fifth highest in the United States.[11,12] The University of Massachusetts Memorial Medical Center is the sole tertiary-care academic referral hospital in central Massachusetts. Its ED sees an annual volume of 130,000 visits, with approximately 600 patients per year presenting for evaluation of complications of OUD. This population is at especially high risk of morbidity and mortality from drug use, representing a group in whom targeted education and harm reduction efforts might yield the greatest benefit.[8] Study staff sought to achieve a sample that is representative of the population of people who use drugs in the region, with respect to gender, age, drugs injected, duration of drug use, and prior experiences with OUD treatment.

Recruitment

The electronic health record ED tracking board was used to screen for individuals with an opioid-related chief complaint (eg, overdose, abscess, request for detox). Potential participants were approached once they had been deemed medically stable by their treating attending physician. A convenience sample was enrolled during the study period (March–November 2019). Eligible participants were 18 years of age or older, presented to the ED with an opioid-related chief complaint, had a history of OUD, were English-speaking, and able to provide informed consent. Individuals were excluded if they had previously participated in this study or were in police custody. Verbal informed consent was obtained.

Data Collection

Study investigators administered a brief demographic survey, followed by a semi-structured interview consisting of open-ended questions regarding experiences with naloxone and opioid withdrawal, attitudes toward MAT and recovery, and familiarity with naltrexone, buprenorphine, and methadone (Appendix A and B). The semi-structured interview guide was developed by senior investigators with prior expertise in qualitative research techniques. Interviews were conducted by trained interviewers with prior experience in other qualitative, open-ended research studies with similar populations. At the conclusion of the interview, participants were compensated for their time with a $10 gift card for a local retail store. We tabulated and managed demographic data using REDCap electronic data capture tools hosted at the University of Massachusetts Chan Medical School.[13,14] Semi-structured interviews were audio recorded and professionally

transcribed. After 20 interviews, senior investigators met with the interviewers to discuss the data collected. Considering that the demographics of the interviewed participants matched that of people who use drugs seen in the ED and that most of the interview questions were addressed by the interviewees, we determined that the sample size was sufficient to adequately explore themes of interest.[15]

Data Analysis

We used an applied thematic analysis and framework matrix analysis to analyze the qualitative interviews. Deductive codes were developed by study investigators (JL and BC) from key topics of interest in the interview guide. Deductive codes included attitudes and experiences with naltrexone, suboxone, and methadone. Additional inductive codes were developed during review of all transcripts to capture novel and emergent concepts brought forth by the participants. Inductive codes included participants' discussion of their experiences of pain and withdrawal. Codes were organized as parent codes, with subcodes representing more specific themes within each category. We found that many of our top level/parent codes were deductive, but that additional subcodes were added to these categories based on participants' concepts, such as the misuse potential of MAT. The majority of our codes were deductive, and approximately six of the 48 codes and subcodes were inductive.

Two researchers (JL and KB) independently openly coded the first two interview transcripts. The obtained codes were reviewed by the research team in aggregate and adjusted as needed (eg, codes were renamed or their definitions clarified). This resulted in a preliminary thematic coding scheme. New codes were created as needed during review of three more transcripts. Throughout this process, codes were discussed and refined until agreement between the researchers was reached. After five interviews, no further changes were made to the codes. The finalized codes were then used on the remaining transcripts, which were double coded by two study investigators (JL and KB) and reviewed and verified by two additional researchers (BC and MT). Differences in coding were resolved and the agreed-upon codes were entered into NVivo 12 Plus (QSR International, Burlington, MA) to complete the thematic analysis and generate summaries of key topic areas. We also made note of important or unique findings. Quotations illustrating relevant themes were selected for presentation.

RESULTS

A total of 47 participants were screened for recruitment. Twenty-two were unable to be approached because they exhibited altered sensorium (11/22); eloped from the ED (3/22); study staff were unavailable to administer the interview (5/22); or other (3/22). Of the 25 individuals approached, five declined to participate because they did not feel well enough to complete the interview (two patients), had no interest in participating (one), or requested immediate discharge from the hospital (two). Twenty participants were enrolled in the study (Table 1). The sample was comprised predominantly of young, White males with prior experience with OUD treatment. The sample varied with respect to educational attainment, current employment, and housing status.

Analysis of semi-structured interviews revealed several themes, described in detail below. Additional illustrative quotations are included for each theme (Table 2).

Experience with Opioid Use Disorder

Most participants (15) had a prior opioid overdose for which they had received naloxone. Nine participants also reported receiving opioid reversal more than once; one participant described being reversed with naloxone "too many [times] to count." Most reported a positive perception of naloxone and were thankful to have received it. Participants possessed a high degree of functional knowledge regarding MAT. All 20 participants had prior direct personal experience with MAT, and individuals were most familiar with methadone and buprenorphine.

Table 1. Participant demographics.

Age, years	
Mean	38.35
Standard deviation (population)	10.52
Median	32.5
Sex, n (%)	
Male	15 (75)
Female	5 (25)
Race, n (%)	
White	14 (70)
Black	3 (15)
Multiracial	2 (10)
Other	1 (5)
Ethnicity, n (%)	
Hispanic or Latino	4 (20)
Non-Hispanic or Latino	16 (80)
Current living situation, n (%)	
House	4 (20)
Apartment	7 (35)
SUD treatment facility/sober living	2 (10)
Homeless	7 (35)
Highest degree/level of school completed, n (%)	
Some high school, no diploma	7 (35)
High school graduate, diploma or equivalent	6 (30)
Trade, technical, or vocational training	2 (10)
Some college credit, no degree	3 (15)
Associates degree	2 (10)

SUD, substance use disorder.

Table 2. Illustrative quotations.

Theme	Quote
Experience with opioid use disorder	"For the last couple of years, … I have not wanted to get high, like shoot dope… I'm 50 … years old. My life sucks. Drugs… have done a number on me… Drugs will take and steal … everything out of your life - until you have no life… I was the … postman. I was a homeowner. I loved my wife. [We had] a beautiful daughter… On my way to work, car accident… This is the late '90s. The doctor was like, '…there's something better out there [than Percocet]. It's Oxycontin.' And now here I am in 2020— still struggling with demons."
	"I mean just not getting high for a month, it can change a whole lot of stuff, and getting high one time in a year and a half could change a whole lot of stuff."
	"No matter what, I'm an addict for life. I admit that. I have an addict mentality. It's gonna be with me… for the rest of my life. 'Til I'm 100 years old… You know what the difference is? Is whether I pick up something or I don't. You know what I mean?"
Attitudes toward and experience with naltrexone	"I have three of my friends right now that are on Vivitrol … they're telling me every day, "Get Vivitrol. Get Vivitrol." … You don't have to think—wake up the next day and say, "Should I take a Sub or should I get high?" You're already wakin' up because you know you can't get high."
	"[I want to go from Suboxone to Vivitrol] to not have to … worry about … not taking that pill one day and then grabbing a bag instead and that being the last day I have on this Earth—"
	"And if they know they can't get high, they don't use, and their life gets better, and slowly, they see the improvement in a period of 28 days."
	"The Vivitrol gets a lot more respect than like people that are on methadone or Suboxone —"
Attitudes toward and experience with methadone	"I don't like methadone … only because it's … more of a substitute for drugs."
	"I like it because … it actually gets ya high. I don't like it because it's the worst come down in the world… Honestly, I think methadone is harder to come off of than heroin."
	"Cause there's no detox… You can just go in there and take methadone, and you're all set."
Attitudes toward and experience with buprenorphine	"[Suboxone] makes me feel like I didn't ever do heroin. I'm not sick anymore. I'm perfectly normal."
	"It's a wonder drug. It really is. It's great. It's never failed me."
Attitudes toward and experience with abstinence-based treatment	"I prefer not to be on any type of maintenance or anything [because] I have mental health issues, and it gives me a better baseline to see where I'm at. Plus, I honestly don't consider that being clean… if I still have to go take an opiate every single day."
	"but there is a certain amount of weakness, especially, I think, in men, that comes when one might have to use another drug in order to keep them off of another drug."
Experience with withdrawal symptoms	"I don't feel autonomous. I don't feel in control of myself. I feel like the withdrawals are controlling everything I'm doing."
	"Hooked, when you stop, you see how you feel. You'd be calling your friend, or callin' your mother, callin' someone so you can get some money so you can buy some [heroin] so you're not sick."

Attitudes Toward and Experience with Methadone

Fourteen participants reported prior treatment with methadone. Some participants were unsure of the mechanism of methadone, and one participant mistook it for an opioid "blocker." Participants viewed methadone positively because it ameliorated withdrawal symptoms during detox, treated pain, improved craving, and facilitated a return to normal daily activities. Participants cited the lack of a required washout period prior to starting methadone as a benefit. One participant identified boredom as a trigger for their opioid use, and thus liked the regimented nature of daily visits to the methadone clinic; the clinic they attended also offered groups and intensive outpatient treatment that helped mitigate the risk factor for return to use.

However, other participants expressed significant reservations regarding methadone. They disliked that they felt "high" from methadone and described it as "more of a substitute for drugs" compared to other treatment options. Several participants found the daily clinic visits to be inconvenient, particularly in extreme weather when they needed to "stand out there in the snow." Others cited concerns regarding prolonged and severe withdrawal symptoms with methadone discontinuation and stigma related to methadone treatment.

Attitudes Toward and Experience with Buprenorphine

Seventeen participants reported prior treatment with buprenorphine. Most participants viewed buprenorphine favorably; one participant called it a "wonder drug." Participants described improvement of withdrawal symptoms, decreased pain, feeling normal/"not high," and ameliorated cravings. One participant had used buprenorphine extended-release injection (Sublocade) and liked the convenience of the 28-day cycle.

One participant noted buprenorphine did not improve withdrawal symptoms after using heroin/fentanyl. Other participants reported adverse effects, such as withdrawal symptoms with discontinuation or missed doses, drowsiness, bad taste/smell, restlessness, nausea, and precipitated withdrawal. While only one participant reported difficulty obtaining a buprenorphine prescription, eight described purchasing illicit buprenorphine to self-treat withdrawal symptoms. Additional reported barriers included the frequency of clinic visits for prescription renewal, concern for untreated pain; desire for more structured programs or concurrent psychiatric treatment; preference for drug-free abstinence; and financial pressures to sell buprenorphine. Some participants were also concerned about the misuse and diversion potential of buprenorphine, and self-reported prior use of buprenorphine to get high or sell their prescription in exchange for other drugs.

Attitudes Toward and Experience with Naltrexone

Fewer participants reported prior personal treatment history with naltrexone (n=6), compared to methadone (n=14) and buprenorphine (n=17). However, most knew someone who had previously been prescribed naltrexone and reported those people described a positive experience due to the inability to use opioids and improvement in cravings.

Most participants described the mechanism of naltrexone as an opioid "blocker." Participants were largely familiar with Vivitrol by brand name, but frequently conflated naltrexone with naloxone due to the similarity of the generic names. Most participants knew naltrexone was formulated as an intramuscular injection, and six participants knew of the pill formulation. Nine participants correctly reported that the effects of injectable naltrexone last for 30 days, while one participant erroneously thought it lasted for 3-6 months.

Presented with a hypothetical scenario in which someone on long-term naltrexone treatment attempted to use opioids, some participants correctly stated that the individual would experience no euphoric effects or could possibly experience euphoria if they used a sufficiently large opioid dose. However, others incorrectly reported that this individual would experience no euphoria but experience imminent death or would experience opioid withdrawal symptoms.

Most participants with prior naltrexone treatment experience regarded it positively. One stated benefit of depot naltrexone was not having to "worry about … not taking that pill one day and then grabbing a bag instead and that being the last day I have on this Earth." Other reported benefits included ease of use, monthly rather than daily administration, and less stigma. Additionally, several participants described that naltrexone helped with cravings. One stated, "[Vivitrol's] a mind controller, you know. It really help[s] you stop thinkin' about [opioids]." Some participants felt there were no side effects or dangers of taking naltrexone, while others reported that potential adverse effects include withdrawal symptoms, overdose, ability to break through the blockade, allergic reaction or rash, depression, injection site soreness, and nausea.

While most participants reported that methadone and buprenorphine were solely for the treatment of OUD, some participants believed that naltrexone was effective for substances beyond opioids (eg, cocaine, "all drugs"). Most participants were familiar with naltrexone also being used for alcohol use disorder. Five participants perceived no barriers to receiving naltrexone. Three participants were concerned about being unable to tolerate withdrawal symptoms prior to naltrexone initiation. Additional barriers included a preference for abstinence-based treatment, difficulty with transportation, risk of relapse or overdose prior to the next dose, desire for the ability to get high, and perceived inability to treat pain.

Participants reported receiving information about naltrexone from OUD treatment programs, from other people who use drugs with prior naltrexone treatment experience, pamphlets, physician, and jail. Seven participants were interested in receiving additional information about naltrexone while eight were not. Participants were interested in learning how and why naltrexone works; adverse effects and toxicity; where and how to access it; positive and negative effects; and whether it had euphoric effects.

Attitudes Toward and Experience with Abstinence-based Treatment

Participants varied in their definition of sobriety, with some defining their goal in recovery as drug-free abstinence, whereas others viewed MAT as a vital part of their recovery. Some participants had experience with abstinence-based treatment; however, most participants reported this usually resulted in return to drug use. The most common reasons for preferring abstinence-based recovery were stigma associated with MAT use and concern that MAT was substituting one drug for another. Additionally, some participants reported involvement with abstinence-based groups as a reason for not wanting MAT, perceiving that these groups equated MAT use with not being sober. Among participants who preferred drug-free abstinence, most acknowledged that abstinence-based sobriety was difficult to achieve from the outset and viewed MAT as a bridge to this long-term goal.

Experience with Withdrawal Symptoms

All but one participant reported previously experiencing symptoms of opioid withdrawal. While many participants felt they could tolerate withdrawal symptoms for a short duration, most felt an extended withdrawal period was unacceptable.

While physical symptoms of opioid withdrawal were common, the most intolerable withdrawal symptoms were neuropsychiatric: insomnia, anxiety, lack of autonomy/feeling controlled by withdrawal symptoms, and hopelessness. Some participants recounted such a strong emotional response that even the thought of withdrawal made them anxious.

Treatment Acceptability

While MAT was generally accepted, several individuals cited the misuse potential of methadone and buprenorphine as reasons for wanting to avoid these therapies. Most participants expressed the importance of having a plan in place to taper off agonist treatment prior to initiation, due to previously experiencing prolonged withdrawal. Many participants were accepting of partial agonist medications (buprenorphine), with seven participants describing it as their preferred treatment modality. Five participants reported they would prefer naltrexone, while others cited precipitated withdrawal symptoms as their main reason for avoiding this medication. Only one participant reported methadone as their preferred medication. There were two participants who reported they would opt for an abstinence-based recovery. Participants also expressed interest in more mental health treatment combined with MAT.

Participants were eager for more information about treatment options, preferring to learn about MAT through discussions or reading materials. Although most participants wanted these conversations to be with a clinician, a few participants preferred to learn from people who use drugs who had personal experience with the treatment options. One participant suggested the information should be easily understood, while another participant preferred to have access to the primary literature.

DISCUSSION

In our sample of 20 ED patients with OUD, all participants had prior experience with MAT; 85% with buprenorphine, 70% with methadone, and 30% with naltrexone. Overall, participants viewed MAT positively. Many participants held strong preferences for a specific agent but differed in the reasons for these preferences. Participants often reported that their own prior experiences, or those of people they knew, influenced their attitudes toward a particular form of MAT.

In a previous qualitative study of people who use drugs in rural New Mexico, participants had more experience with buprenorphine than methadone, felt that treatment with MAT improved withdrawal symptoms and quality of life, preferred buprenorphine to methadone, and cited dislike for being dependent on MAT due to stigma and the perception of substituting one drug for another.[16] It is noteworthy that individuals in environments as disparate as rural New Mexico and urban New England share such similar perspectives regarding MAT. Our results underscore the importance of combating the stigma associated with OUD, addressing common fears surrounding MAT and opioid withdrawal, and understanding individual definitions of sobriety.

Our results should inform discussions with people who use drugs and refine OUD treatment programs. Importantly, the current standard of care for treating opioid withdrawal consists primarily of medications that ameliorate its physical symptoms but do little to mitigate the psychological symptoms that were reported to be far more unpleasant. Additionally, it is imperative to note that when people who use drugs are engaging in OUD treatment, many are already thinking ahead to when they may be discontinuing MAT and considering potential withdrawal effects as a significant factor in evaluating the suitability of a particular form of MAT. Therefore, engagement in initiating MAT among ED patients may be improved by addressing not only the current withdrawal symptoms and short-term benefits but also long-term concerns such as potential withdrawal symptoms when discontinuing MAT. This knowledge should be leveraged in the initial discussions of treatment options, to help inform people who use drugs of the advantages and disadvantages of each, and to empower them to select the option most suitable for their individual circumstances. Lastly, naltrexone may be an acceptable treatment modality for individuals who wish to pursue drug-free recovery.

LIMITATIONS

The main limitation of the present study is the lack of diversity among the study participants, who were mostly young, White males. The population is representative of the typical sample of people who use drugs in our region, and we did not find a difference in characteristics between approached vs enrolled participants. Because this was a convenience sample, there is a possibility for selection bias in which participants more comfortable with discussing their OUD agreed to participate in the qualitative interview.

There were also several limitations inherent in this qualitative research project. All study staff were trained in qualitative interview techniques; however, interviews were conducted by three different interviewers. Consequently, there is potential for variation in the way questions were asked, as is to be expected in a semi-structured qualitative interview. Data was analyzed by the qualitative interviewers; coding credibility and reliability were addressed by having two independent reviewers code the data, which was then reviewed and verified by two additional reviewers, each of whom individually reviewed the codes and entered the data. Thematic analysis was written using coding summaries and notes from the qualitative data. Themes were written by JL and reviewed by all analysts at team meetings to ensure agreement about the interpretation and representation of this data.

CONCLUSION

Overall, participants had a positive view of medications for addiction treatment but tended to have strong preferences

for a particular agent, based upon previous personal experience or anecdotes from people who use drugs that they knew. Willingness to engage in a specific therapy was affected by the perceived likelihood of experiencing withdrawal symptoms and their anticipated severity, both during treatment initiation and cessation. Future outreach efforts should specifically elicit an individual's conceptualization of sobriety and address the relative benefits and drawbacks of agonists, partial agonists, and antagonists within that framework.

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Gamification of POCUS: Are Students Learning?

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Introduction: While gamification of point-of-care ultrasound (POCUS) is well received by learners, little is known about the knowledge gained from material taught during these events. We set out to determine whether a POCUS gamification event improved knowledge of interpretation and clinical integration of POCUS.

Methods: This was a prospective observational study of fourth-year medical students who participated in a 2.5-hour POCUS gamification event consisting of eight objective-oriented stations. Each station had one to three learning objectives associated with the content taught. Students completed a pre-assessment; they then participated in the gamification event in groups of three to five per station and subsequently completed a post-assessment. Differences between pre- and post-session responses were matched and analyzed using Wilcoxon signed-rank test and Fisher's exact test.

Results: We analyzed data from 265 students with matched pre- and post-event responses; 217 (82%) students reported no to little prior POCUS experience. Most students were going into internal medicine (16%) and pediatrics (11%). Knowledge assessment scores significantly improved from pre- to post-workshop, 68% vs 78% (P=0.04). Self-reported comfort with image acquisition, interpretation, and clinical integration all significantly improved from pre- to post-gamification event (P<0.001).

Conclusion: In this study we found that gamification of POCUS, with clear learning objectives, led to improved student knowledge of POCUS interpretation, clinical integration, and self-reported comfort with POCUS. [West J Emerg Med. 2023;24(2)243–248.]

INTRODUCTION

While the definition of gamification varies, the overarching theme refers to the use of game elements and logistics in traditionally non-game contexts.[1] This idea has been used in business to motivate employees, as a marketing strategy for sales, and is now becoming more popular in education.[2,3] The goal of gamification in education is to increase learner engagement and improve learning outcomes.[4] Gamification has been shown to improve learner engagement in medical education and has high learner-satisfaction rates.[5] A recent review concluded that gamification is "a promising tool to improve learning outcomes by strengthening learning behaviors and attitudes towards learning."[5] Examples are widespread within a variety of contexts and specialized training including internal medicine, surgery, and neurology, among many others.[6-8]

Building on the gamification movement, a competitive gamification approach for point-of-care ultrasound (POCUS) was first popularized by the SonoGames competition that began at the Society for Academic Emergency Medicine Annual Meeting in 2012.[9] The basis of this competitive event was to use games and competition-based learning as a tool for resident ultrasound education. Results from this and other gamification events have shown an increase in resident enthusiasm for POCUS learning.[10] Despite the popularity of this approach, little is known about the ability of a gamification event to improve POCUS knowledge and skill. Based on the principles of competitive gamification, we created a POCUS learning competition for graduating fourth-year medical students to review pertinent POCUS learning objectives included in the longitudinal POCUS curriculum. The purpose of this study was to determine whether this gamification event improved POCUS knowledge, ability to recognize pathology on ultrasound images, and ability to incorporate POCUS findings into a clinical scenario.

Population Health Research Capsule

What do we already know about this issue?
Gamification of ultrasound improves learner engagement and enthusiasm for point-of-care ultrasound (POCUS).

What was the research question?
Does gamification improve POCUS knowledge for learners?

What was the major finding of the study?
A gamification event significantly improved POCUS knowledge (P=0.04) and self-reported POCUS comfort (P<0.001).

How does this improve population health?
Gamification of POCUS was found to be a useful tool to improve medical student learning and medical decision-making.

METHODS

Study Design

This was a prospective observational cohort study assessing fourth-year medical students' knowledge of POCUS before and after a gamification event. This event was part of their undergraduate medical education (UME) curriculum, and attendance was required. We collected data on 265 students over eight separate events, held from February–April 2022. This study was deemed exempt by the institutional review board with waiver of informed consent.

A UME longitudinal POCUS curriculum was implemented during the participating students' second year of medical school. In second year, cardiac with inferior vena cava, aorta, renal, bladder volume, and fluid assessment/focused assessment with sonography in trauma (FAST) ultrasound were a required part of the curriculum. During third-year clerkships students learned ultrasound-guided vascular access, cardiac, lung, first trimester obstetric, aorta and FAST ultrasound. In fourth year, students learned rapid ultrasound in shock and hypotension (RUSH) during their required emergency medicine (EM) rotation.

Study Protocol

Eight gamification events took place on three separate days over three months. The fourth-year medical school class was divided into eight groups, so that roughly an equal number of students were present during each event. This was a requirement due to COVID-19 social distancing precautions. Each event lasted two-and-a-half hours and covered the same content. Students were divided into groups of three to five and rotated through eight stations. These eight stations covered POCUS topics including physics, first trimester obstetrics, soft tissue, deep venous thrombosis, vascular access, hypotension, lung, and gallbladder. Stations lasted 10 minutes and included a combination of hands-on scanning of live models for gallbladder; homemade soft tissue; and deep venous thrombosis phantoms and Blue Phantom ultrasound simulation (CAE Healthcare Inc, Sarasota, FL) for peripheral intravenous phantoms. In addition, an obstetric simulator Vimedix Ob/Gyn manufactured by CAE was used for first trimester obstetrics, and a SonoSim simulator (SonoSim, Santa Monica, CA) was used for hypotension/RUSH. Each station had one to three learning objectives and instructors covered content regarding indications, POCUS image acquisition, interpretation, and clinical integration (see Table 1).

Each station was led by a faculty or fellow instructor with POCUS training. Teams performed required tasks at each station to earn points, with a maximum of 10 points awarded at each station. Two teams with the top scores competed against each other in a final competition, which required answering questions correctly for three clinical scenarios with respective pathologic ultrasound images. The cases included the following: a soft tissue abscess in a patient with an area of erythema and tenderness; pulmonary congestion (>2 B-lines in at least two lung zones bilaterally) in a dyspneic patient with end-stage renal disease; and a positive FAST ultrasound in a trauma patient.

Prior to the gamification event students completed a pre-assessment. The pre-assessment questions included which specialty students were applying to for residency training, and students' prior experience with POCUS. Using a five-point Likert scale we assessed each student's comfort level

Table 1. Station learning objectives.

Station	Objectives
OB	- Students will be able to identify an IUP on ultrasound
Physics	- Students will be able to identify posterior acoustic enhancement
Soft tissue	- Students will be able to recognize an abscess on ultrasound - Students will be able to determine the correct treatment for a patient with a skin and soft tissue infection based on ultrasound findings
PIV	- Students will be able to differentiate an artery from a vein
Hypotension/ RUSH	- Students will be able to identify free intraperitoneal fluid in the RUQ - Students will be able to determine the correct management for a hypotensive patient with a positive FAST
Lung	- Students will be able to identify B-lines on lung ultrasound - Students will be able to determine the correct treatment for a short of breath patient with B-lines
Gallbladder	- Students will be able to identify normal gallbladder anatomy with ultrasound - Students will be able to recognize ultrasound findings of acute cholecystitis
DVT	- Students will be able to identify or name ultrasound characteristics of DVT - Students will be able to identify risk factors for DVT - Students will be able to determine the correct management for DVT

DVT, deep venous thrombosis; *FAST,* focused assessment with sonography in trauma; *IUP,* intrauterine pregnancy; *OB,* obstetrics; *PIV,* peripheral intravenous; *RUQ,* right upper quadrant; *RUSH,* rapid ultrasound in shock and hypotension.

in acquiring, interpreting POCUS images, and incorporating POCUS findings into patient care scenarios. There were nine knowledge questions that covered image interpretation (six questions) including normal, pathology or artifact, and patient management after interpreting images (three questions). Eight questions were multiple choice, and one question was true/false. The post-assessment questions were the same as the pre-assessment questions. This was by design to determine true changes in knowledge and decrease potential confounders associated with image quality or understanding of what the question was asking. Students were not given the answers to the questions. Additionally, we evaluated the students' learning experience during the event. Assessments were made available by QR codes immediately prior and after the event. We collected data directly into REDCap electronic data capture tools hosted at Indiana University (Research Electronic Data Capture).

Data Analysis

We analyzed differences between pre- and post-event assessment responses using chi square with $P < 0.05$ being significant. We performed all statistical analyses using Vassar Stats (http://vassarstats.net, Poughkeepsie, NY) and Microsoft Excel (Microsoft Corp, Redmond, WA).

RESULTS

A total of 289 fourth-year medical students participated in the gamification event. We analyzed data on 265 (92%) students who completed both a pre- and post-event assessment. We were missing matched data from 24 students. Most students were planning to go into internal medicine (42, 16%); pediatrics (30, 11%); surgery (29, 11%); and EM (29, 11%) for residency training; 217 (82%) students had limited to no prior hands-on POCUS experience (see Table 2).

Comparing pre- to post-event responses, we found students were more confident in doing the following: acquiring POCUS images, mean 2.56-3.57 on a five-point Likert scale ($P<0.001$); interpreting POCUS images, median 2.52-3.51 ($P<0.001$); and integrating POCUS within a clinical context, median 2.66-3.52 ($P<0.001$). Overall, POCUS knowledge scores improved from pre- to post-gamification event (68% correct to 78% correct, $P=0.04$). (See Table 3 for breakdown by modality.) Knowledge of image interpretation improved from 67% to 78% and clinical integration improved from 69% to 78%. Knowledge in lung ultrasound showed the biggest improvement. Knowledge regarding the ability to differentiate a vein from an artery remained high pre- and post-event. Soft-tissue ultrasound image interpretation and clinical integration of these findings worsened after the event.

Overall, 241 (91%) students rated this learning experience as good to excellent, with three (1%) rating it poor. One hundred ninety-one (72%) students felt the content taught during the gamification event was essential to their future practice, and 25 (9%) felt that the content was not essential to

Table 2. Student demographics.

Future specialty	n (%)
Internal medicine	42 (16)
Pediatrics	30 (11)
Surgery	29 (11)
Emergency medicine	29 (11)
Other	135 (51%)
Level of prior ultrasound experience	
None	9 (3.4)
Some/used a few times	208 (78)
Moderate/use a couple times per month	46 (17)
Large amount/use weekly	1 (0.6)

Table 3. Knowledge scores pre- and post-gamification event, N=265.

	Pre	Post	P-value
Physics Able to identify posterior acoustic enhancement	187 (71%)	229 (86%)	<0.001
OB Able to identify a yolk sac within a gestational sac	115 (43%)	176 (63%)	<0.001
OB Able to identify an intrauterine pregnancy	213 (80%)	229 (86%)	0.04
Soft tissue Able to diagnose an abscess	194 (73%)	154 (58%)	0.11
Soft tissue Treat abscess with an incision and drainage procedure	167 (63%)	142 (54%)	<0.001
Vascular access Differentiate a vein from an artery	238 (90%)	249 (94%)	0.22
Hypotension Able to determine correct treatment for hypotensive patient with a +FAST	201 (76%)	242 (91%)	<0.001
Lung Identify B-lines	160 (60%)	239 (90%)	<0.001
Lung Determine the correct treatment for a short-of-breath patient with B-lines	148 (56%)	209 (79%)	0.01

FAST, focused assessment with sonography in trauma; *OB,* obstetrics.

their future practice.

DISCUSSION

Gamification of POCUS is a teaching method used to engage and motivate learners through competition.[9] This method has been well received by resident learners who have found that POCUS gamification events are an effective educational experience with high satisfaction.[10,11] Prior studies have shown that gamification as a teaching method improves knowledge; however, this has not been well studied in the field of POCUS. In this study, we found that a POCUS gamification event given to fourth-year medical students improved confidence (P<0.001) and knowledge with POCUS (P=0.04).

We assessed knowledge gained from a POCUS gamification event through direct comparison of pre- and post-knowledge questions. A prior study designed by Liteplo et al to assess the effectiveness of a POCUS gamification event conducted a post-event assessment of residents and POCUS program directors and found that residents reported their ultrasound knowledge and clinical use of POCUS increased.[10] The Liteplo study showed how gamification events can increase enthusiasm and potentially improve use of POCUS; however, this prior data was limited by a small sample size and survey methodology used to assess both knowledge and usage.

Lobo et al[11] evaluated effectiveness from a two-day POCUS gamification event to EM interns through use of a pre- and post-knowledge assessment. They found improved knowledge with a pre- to post-test score difference of 1.19 (P<0.05). Lai et al[12] randomized 31 doctors with two to four years of clinical experience to a gamified arm vs conventional learning. In their study, they found both methods of teaching significantly improved knowledge and skill, with the participants in the gamification arm stating that this method of teaching was useful in motivating them to learn the RUSH examination. The data from these studies was similar to our study results, finding improved POCUS knowledge after a gamification event. However, they were limited by a small sample size, and it is unknown whether the differences in pre- to post-event knowledge was gained in basic technical skill, image interpretation, or clinical integration.

Although we found improvement in self-rated confidence and knowledge with POCUS, not all areas improved. Interestingly, soft-tissue ultrasound knowledge worsened when comparing knowledge before to after the event. The knowledge assessment included a clinical vignette with an image of an abscess with associated cobblestoning: pre- to post-event 63% vs 54% chose the correct response—an abscess, while 22% vs 45% chose cellulitis. While cellulitis was present in the image, it was important for students to recognize an abscess to guide appropriate management of the patient. This led most students to choose antibiotics alone as a treatment option instead of incision and drainage as the correct response for the subsequent question. Soft tissue ultrasound is one of the easier imaging modalities to perform and interpret.[13] It is possible that students focused on the cobblestoning, which was present in the image, and disregarded the rest of the image, which also included a fluid collection. It is less likely a result of instruction, as abscess was covered in depth during the soft tissue station and the hands-on portion of the station involved students performing an ultrasound- guided abscess drainage. Additionally, abscess was discussed and shown to students during the deep venous thrombosis station.

Knowledge in lung ultrasound showed the biggest improvement: 60% correct to 90% correct for interpretation; and 56% to 79% correct for clinical integration. This is most likely a reflection of the ease of learning, performing, and interpreting lung ultrasound.[14,15] These results suggest that lung ultrasound is a suitable POCUS modality for teaching during a gamification event whereas other modalities, such as soft tissue ultrasound, are more complex and may require more time to learn than a gamification event would allow.

A POCUS gamification event requires a significant amount of time and resources to plan and implement, typically taking months of planning[9] and multiple scheduled meetings to discuss content, flow of event, instructor education, and development of materials and phantoms. Despite this, we believe it is a worthwhile teaching modality as it was well received by students and residents, as described in this study and others, [10,11] and importantly increased POCUS knowledge.

LIMITATIONS

There are several study limitations to consider, which will limit its generalizability. We conducted the study at a single medical school with the participants solely comprised of fourth-year medical students. Stations were created and facilitated by faculty and fellows with advanced training in clinical ultrasound. The ability to reproduce these findings will depend on the development of a curriculum with simple, well-defined, and measurable objectives that can be conducted by an array of instructors regardless of their ultrasound training background. Additionally, we did not assess participant psychomotor skills. Although hands-on scanning was involved with every station, some stations used standardized patients, while most stations used phantoms. This, in addition to time restrictions for the event, limited our ability to assess psychomotor skills for each student independently.

We did not assess for retention of knowledge over time. Lastly, following Kirkpatrick's model of training, this event largely focused on *learning* and *reaction* by determining student satisfaction and knowledge.[16] While the data from our study adds to the literature by demonstrating how gamification of POCUS can lead to improved knowledge, future studies should focus on psychomotor skills acquired during a gamification event, knowledge retention, and how the knowledge gained from this event impacts future behavior.

CONCLUSION

We found that gamification of POCUS, with clear learning objectives, led to improved student knowledge and to an increase in self-reported comfort in acquiring and interpreting images as well as incorporating POCUS into clinical practice. This is the first study to our knowledge involving a large cohort of undergraduate medical students in a POCUS gamification event. Over 88% of students reported this experience as good or excellent, and more than 70% of students rated the skills taught during this course as essential to very essential to their future practice. Gamification of POCUS proved to be a useful tool in improving student learning and their medical decision-making based on complementing information acquired clinically and through ultrasound image interpretation.

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Impact of the Las Vegas Mass Shooting Event on the Graduate Medical Education Mission: Can There Be Growth from Tragedy?

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Introduction: Our aim was to determine the psychological and educational impact of the 2017 Las Vegas mass shooting on the graduate medical education (GME) mission within two cohorts of resident physicians and attending faculty at two nearby academic trauma centers.

Methods: A cross-sectional survey assessed 55 resident physicians and attending faculty involved in the acute care of the patients from the mass shooting. We measured the psychological impact of the event, post-traumatic growth, team cohesion, social support, and known risk factors for post-traumatic stress disorder (PTSD). Additionally, we assessed the impact of the event on GME-specific tasks.

Results: Attending faculty and physicians in training in GME residencies evaluated over 300 penetrating trauma patients in less than 24 hours, and approximately 1 in 3 physicians had a patient die under their care. Despite this potential for psychological trauma, the majority of clinicians reported minimal distress and minimal impact on GME activities. However, 1 in 10 physicians screened positive for possible PTSD. Paradoxically, the minority of physicians who sought psychological counseling after the event (20%) were not those who reported the highest levels of distress. Residents generally assessed the event as having an overall negative impact on their educational goals, while attendings reported a positive impact. Psychological impact correlated inversely with social support and the amount of prior education relating to mass casualty incidents (MCI) but correlated directly with the degree of stress prior to the event.

Conclusion: Despite the substantial level of exposure, most resident physicians did not report significant psychological trauma or an impact on their GME mission. Some reported post-traumatic growth. However, a minority reported a significant negative impact; institutions should consider broad screening efforts to detect and assist these individuals after a MCI. Social support, stress reduction, and education on MCIs may buffer the effects of future psychologically traumatic events on physicians in training. [West J Emerg Med. 2023;24(2)249–258.]

INTRODUCTION

Teaching hospitals serve a dual role, providing for both graduate medical education (GME) and patient care. This necessarily intertwines teaching and learning activities with unpredictable and traumatic patient care events such as mass casualty incidents (MCI). Mass shootings, which occur in the United States at a rate of approximately one every 12.5 days,[1] represent a subset of MCIs with a potential to inflict profound psychological distress on physicians. Exposure to such events may lead to disruption of personal and professional activities and lead to acute stress disorders, sleep disturbances, anxiety, depression, complicated grief, and psychological distress.[2]

One such event occurred on October 1, 2017, when an individual armed with multiple weapons opened fire on spectators at the Route 91 Harvest Music Festival in Las Vegas, Nevada. This event was the deadliest mass shooting in US history[3]: 58 people died at the scene or soon thereafter, with two additional deaths from subsequent complications of injuries. Over 400 additional patients sustained penetrating injuries from gunshots and/or shrapnel, with hundreds of other injuries sustained in the subsequent panic of the crowd.[4] The overwhelming volume and acuity of critically injured patients exceeded the capacity of emergency medical services at the concert venue, and large numbers of patients were transported to hospitals by private vehicles. Two nearby trauma centers, Sunrise Hospital and Medical Center (SHMC) and University Medical Center of Southern Nevada (UMC), both academic training facilities, received most of the injured patients and cared for hundreds of gunshot patients over the span of a few hours. The attending and resident physicians from these centers were exposed to an extraordinary number of emotionally intense traumatic injuries, far beyond the typical experience of clinicians.

Psychologically traumatic exposures such as this can lead to significant post-traumatic stress for some healthcare workers.[5] The emergency department (ED) setting, where attending and resident physicians stabilize victims of trauma, has historically reported high rates of post-traumatic stress.[6] Rates of post-traumatic stress disorder (PTSD) range from 2.2-24%, depending on definition and measurement technique.[5] Affected physicians may show typical signs of post-traumatic stress including involuntary upsetting memories, flashbacks, involuntary responses to external cues, and physical symptoms such as palpitations upon exposure to a reminder of the event.[7] However, most physicians exposed to psychologically traumatic events do not develop PTSD. Thus, systemic or personal factors, beyond mere exposure, contribute to the psychological impact of a traumatic event on an individual physician.[8]

The best researched systemic factor demonstrating a consistent inverse relationship with the risk of development of PTSD is the degree of social support.[9] Prior training in stressful events, and methods of coping with the psychological aftermath, have also correlated with a protective effect against the development of PTSD.[10,11] Individual factors linked to the development of PTSD include age (older individuals are at higher risk), the amount of professional training and education (more years are protective), and the presence of pre-existing mental health disorders (those impacted are at increased risk).[5] While traumatic events may cause substantial negative impact, for some individuals trauma may lead to growth. Post-traumatic growth is a well-researched process in which an individual exposed to a psychologically traumatic event undergoes productive personal development leading to higher functioning.[12] Post-traumatic growth occurs through changes in one or more of several psychological domains: appreciation of life, relationship with others, new possibilities or purpose in life, personal strength, or spiritual change.[13]

While several studies have looked at the impact of stressors such as pandemics and MCIs on physicians' personal lives, and to a lesser extent their professional lives, there is a paucity of evidence on the impact of traumatic events specifically on the GME mission. The lack of understanding of this potential impact is especially concerning given that academic hospitals, which are frequently larger urban trauma centers, often provide a disproportionate amount of patient care during these MCIs. Thus, in our study we sought to evaluate the self-reported impact of the deadliest mass shooting event in US history on peri-traumatic stress, post-traumatic growth, and GME-related activities among residents and attending faculty at two teaching hospitals.

Population Health Research Capsule

What do we already know about this issue?
Caring for patients from mass shootings and catastrophes can impact clinicians' personal and professional lives, with a minority developing symptoms of post-traumatic stress disorder.

What was the research question?
How did the Las Vegas mass shooting impact the academic activities of the residents and faculty involved?

What was the major finding of the study?
The Impact on academics was negative for residents, positive for attendings (2.5 vs 4.9 on 1 to 7 scale; $P < 0.01$).

How does this improve population health?
Academic trauma centers can better understand the complex impact of mass shooting events on their physicians, potentially resulting in improved care for their community.

METHODS

Study Design and Subjects

Approximately six months following the shooting, we performed a post-exposure, cross-sectional survey involving resident and attending physicians who were present during the event at the two teaching hospitals impacted: SHMC is a Level II trauma center that treated over 200 mass casualties that evening, and UMC is a Level I trauma center that treated 104 patients. The timing of the survey represented the earliest point that the researchers were able to develop a protocol and obtain institutional review board (IRB) approval at both institutions following the event. No contemporaneously recorded logs of physicians present during the event exist due to the chaos that evening and the addition of unscheduled clinicians from multiple disciplines who arrived on scene spontaneously. Thus, we obtained a list from both institutions of all credentialed physicians who had potentially assisted during the mass shooting event. All physicians were contacted by email with an introduction to the study, a link to the survey, and a request for participants who were involved in caring for the patients from this event either the evening of October 1, 2017, or the morning after. Those who confirmed involvement were included in the study. The study was approved by the IRBs of both SHMC and UMC.

Assessment Tools

To determine the range of exposure to potentially psychologically traumatic events participants were asked a series of "yes" or "no" questions regarding their overall involvement in the events following the shooting. While many participants assumed direct patient care roles some may have provided non-clinical activities such as assisting with supplies, providing information, or offering psycho-social support. These questions included the following:

- *Did you personally provide direct care to a shooting victim?*
- *Did you personally have a patient from the Las Vegas shooting, who you were treating, die during your care?*
- *Did you personally have to inform relatives or loved ones of a patient's death?*
- *Did you personally witness images resulting from violence that were out of the ordinary for you as a physician?*
- *Did you feel personally at risk of injury or death during the event?*

The survey included four previously psychometrically validated scales as outcome measures. The Impact of Events Scale – Revised (IES-R) is a 22-item self-report of the degree of subjective distress following a traumatic event. Respondents assess the degree to which they experience each item on a five-point scale ranging from "not at all" to "very much."[14] Post-traumatic growth was assessed with the Post Traumatic Growth Inventory - Short Form (PTGI), a 10-item scale with ranges between zero ("did not experience this") and five ("experienced to a very great degree").[15] This scale captures the degree of positive changes in each of the five domains of growth that may occur following a traumatic event.

We assessed the impact of environmental factors using two scales: the Multidimensional Scale of Perceived Social Support (MSPSS) and four items measuring team cohesion from the Team Development Measure. The MSPSS is a 12-item scale with ranges between 1 ("very strongly disagree") and 7 ("very strongly agree") that captures perceived social support from family, friends, and significant others.[16] The team cohesion factor (TCF) consists of a four-item scale that measures the degree to which the respondent feels the team they were on was united and that they personally contributed to the overall mission of the team, using a five-point Likert scale from "strongly agree" to "strongly disagree."[17]

In addition, several questions were asked to assess the perceived personal impact of the event, scored on a seven-point Likert scale. These questions were developed by a review of the literature, item development, and then content validation by group discussion among authors with expertise in clinical psychology. The question structure was developed by one author who is an academic psychologist with expertise in survey design methodology. These questions included the following:

- *How frequently have you found yourself avoiding a particular type of patient? For example, avoiding treating patients with penetrating trauma.* [Anchors of "Never" to "All the Time"]
- *How frequently have you found yourself having difficulty taking care of a particular type of patient? For example, having strong emotions while treating patients with penetrating trauma.* [Anchors of "Never" to "All the Time"]
- *In general, how would you say the Las Vegas shooting experience impacted your academic clinical practice? (Ability to teach, model, and perform in GME)?* [Anchors of "Strong Negative Impact" to "Strong Positive Impact"]
- *I have considered changing my specialty because of the event.* [Anchored "Strongly agree" to "Strongly disagree"]
- *I have considered leaving the field of medicine because of the event.* [Anchored "Strongly agree" to "Strongly disagree"]

Other known risk factors for peri-traumatic stress were assessed by the following questions:

- *Prior to the shooting, did you ever seek treatment for any of the following conditions? Anxiety, depression, PTSD, obsessive/compulsive disorder, personality disorder, Any other mental health condition.* [Coded as Yes/No]
- *Other than the Las Vegas shooting have you previously had an exposure to an event you considered to be*

psychologically traumatic to you? [Coded Yes/No]

- *In the seven days leading up to the shooting, how stressed would you say you were?* [Coded on a seven-point Likert scale from "Not at all" to "Extremely"]
- *Prior to the shooting, approximately how much prior formal training had you had regarding mass casualty events?* [Coded as "none," "1-2 hours," "2-3 hours," "3-4 hours," or "more than 4 hours"]
- *Prior to the shooting, approximately how much formal training had you completed regarding the psychological impact of critical incidents such as the shooting?* [Coded as "none," "1-2 hours," "2-3 hours," "3-4 hours," or "more than 4 hours"]

Participant age was not included in the survey due to concerns about maintaining anonymity.

We determined types of GME activities common to residents and attendings by a review of the Accreditation Council for Graduate Medical Education Program Requirements and discussion between authors. Participants were asked, *"What impact, if any, has the event had on your ability to complete these education-related tasks?"* Responses for each type of activity fell on a nine-item Likert scale ranging from "Much Easier Now" to "Much Harder Now," with the mid-range labeled as "No impact." Table 1 shows the GME activity-related questions for attendings and residents.

Table 1. Graduate medical education (GME)-related survey questions by GME role.

Prompt: What impact if any has the event had on your ability to complete these GME-related tasks?
Attending Physician
• Reading or studying CME articles or other material relevant to training residents
• Participation in teaching rounds, educational half-days, noon conferences, or didactics
• Completing the required residency administrative tasks such as resident evaluations and time sheets
• Providing teaching during resident presentation of patients
• Performing procedures such as operating, intubating, chest tubes, etc.
• Communicating with patients and families
• Working on research projects or academic scholarly activities
• Recalling specific information when you need it (memory)
• Providing day-to-day feedback and guidance to residents
Resident Physician
• Reading or studying the material you need to know
• Participation in teaching rounds, educational half-days, noon conferences, or didactics
• Completing the required residency administrative tasks such as procedure logs, evaluations, and case logs
• Presenting patients to an attending, fellow, or senior resident
• Performing procedures such as operating, intubating, chest tubes, etc.
• Communicating with patients and their families
• Teaching medical students or other learners
• Recalling specific information when you need it (memory)
• Working on research projects or academic scholarly activities

GME, graduate medical education; *CME,* continuing medical education.

Statistical Analysis

We present the survey results with descriptive statistics (mean, standard deviation). Univariate associations between continuous variables were determined by Pearson product moment correlations. The association between binary "yes/no" questions and the IES-R and PTGI were measured by point biserial correlation. We measured the associations between both the IES-R and the PTGI with questions with ordinal answer sets (eg, "Less than 1 hour," "1-2 hours," or "2-3 hours") with Spearman's rho. We used a two-tailed Student's *t*-test for comparisons between residents and attending physicians on continuous variables that were normally distributed according to the Shapiro-Francia test for normality. Non-normally distributed variables were compared with the Mann-Whitney U test. To determine whether the event differentially impacted certain types of GME-related activities, we conducted two separate within-subjects ANOVAs for attendings and residents. There was minimal missing data, but when present in any given statistical analysis it was handled by listwise deletion. We calculated statistics with STATA version 15 (StataCorp., College Station, TX).

RESULTS

Description of Participants

A total of 320 physicians were contacted by email. Of these, 55 (17%) confirmed their involvement in the event and completed the survey: 38 attending faculty and 17 residents. We cannot determine the response rate as a function of all physicians who actually participated in the care of patients during the shooting (as opposed to all physicians credentialed at both hospitals) because no accurate record exists from the event itself. Of the attending physicians 15 identified as emergency medicine (EM), eight as general surgery, four as anesthesiology, three as surgical subspecialties, and two as radiology, while six did not identify their role. Of the residents, there were 11 general surgery, four EM, and one family medicine resident, and one who did not identify their role.

Psychological Impact and Comparisons by GME Role

Table 2 shows the degree of exposure to psychologically traumatic events reported by study participants, and Table 3 shows the summary results of our outcome variables. The results of the IES-R (psychological impact) and PTGI (post-traumatic growth) did not differ by group when comparing those who endorsed specific exposures (directly provided care, had a patient die in their care, participated in death notification) to those who did not. Six of 15 residents (40%) and 19 of 36 attendings (53%) endorsed a prior

Table 2. Proportion of respondents with exposure to potentially traumatizing experiences.

	Residents N = 17	Attendings N = 38
Provided direct care for a shooting victim.	14 (82%)	30 (79%)
Patient died in the care of the participant.	7 (41%)	12 (32%)
Participant informed a relative or loved one about a death.	2 (12%)	2 (5%)
Personally witnessed images resulting from violence that were out of the ordinary for them as a physician.	5 (29%)	19 (50%)
Did you personally feel at risk of injury or death?	0 (0%)	0 (0%)

psychologically traumatizing experience. (Two in each group did not answer.) This ratio does not differ by role (chi square = 0.27, *P* = .60). Four of 15 residents (27%) and six of 36 attendings (17%) endorsed a prior mental health condition. (Two in each group did not answer.) This ratio does not differ by role (chi square = 0.69, *P* =.41). Comparing those participants who endorsed prior mental health conditions to those who did not we found no statistically significant differences in social support (MSPSS), psychological impact (IES-R), team cohesion, PTGI or the global impact question. We found a similar lack of significant differences when comparing those participants who endorsed a prior psychologically traumatic experience to those who did not. The large majority of both attendings (89%) and residents (82%) reported no subsequent difficulties involving either avoiding certain types of patients (eg, trauma) or with distress associated with seeing certain types of patients after the event. Few participants reported they would consider either changing specialties (4%) or leaving medicine (7%) specifically as a result of exposure to this event.

The mean and standard deviation of the standardized scales and the degree of stress prior to the event are shown in Table 4. All scales were non-normally distributed. Residents and attendings did not differ on the IES-R, PTGI, TCF, or the degree of stress perceived prior to the event. Residents reported slightly higher social support. Four of the 38 attending physicians (11%) and two of the 17 residents (12%) scored above the standard cutoff of 24 to signal concern for PTSD. Two of the four attending physicians scored above 33, the standard cutoff for "probable" PTSD.[18] Participants who screened positive for PTSD came from EM, anesthesiology, and one additional specialty in the "other" category. Only three of the 17 residents (18%) and seven of the 34 attendings (21%) undertook specific formal efforts to mitigate the psychological impact of the event. Notably, of the six participants scoring above the cutoff on the IES-R

Table 3. Summary outcomes of measured variables.

Construct	Instrument	Outcome
Psychological impact/risk for PTSD	IES-R	4 of 38 attendings and 2 of 17 residents screened positive for possible PTSD. Of these, 2 attendings and 0 residents screened positive for probable PTSD.
Post-traumatic growth	PTGI	0 of 17 residents and 4 of 38 attendings scored at or above moderate post-traumatic growth cutoffs.
Perceived social support	MSPSS	Residents report slightly higher perceived social support than attendings.*
Team cohesion	TCF	Residents and attendings reported similar team cohesion.
Perceived stress prior to the event	Stress	Residents and attendings reported similar perceived stress prior to the event.
Prior mental health condition	Yes/no questions	6 of 26 attendings and 4 of 15 residents endorsed prior mental health conditions.
Prior psychologically traumatic event	Yes/no question	19 of 36 attendings and 6 of 15 residents endorsed a prior psychologically traumatic event.
Prior MCI training	Ordinal options	The modal response for both residents and attendings was >4 hours.
Prior training on psychological impact of MCIs	Ordinal options	The modal response for both residents and attendings was "none." However, 6 of the 38 attendings and 4 of 17 residents reported > 4 hours.
Impact of event on core GME tasks	Ordinal options	Attendings: 94% "no impact," 2% "negative impact," and 4% "positive impact." Residents: 71% "no impact," 18% "negative impact," and 11% "positive impact."
Overall impact on GME	Likert Scale	Residents reported the event had a negative overall impact and attendings reported the event had a slightly positive overall impact.*

Unless noted, rates do not differ statistically between residents and attendings.
*P<0.05. Cutoff for IES-R "possible" PTSD is a score > 23 and "probable" PTSD is a score > 32.
Cutoff for PTGI for "moderate" post-traumatic growth is >29.
IES-R, Impact of Event Scales – Revised; *PTGI,* Post Traumatic Growth Inventory; *PTSD,* post-traumatic stress disorder; *MCI,* mass casualty incident; *GME,* graduate medical education.

Table 4. Outcomes of measured variables by graduate medical education role.

				Mann-Whitney U Test			
					Sample size**		
Construct	Instrument	Attending M (SD)	Resident M (SD)	U	Att	Res	*P*
Psychological impact/post-traumatic stress	IES-R	10.0 (12.5)	12.1 (17.1)	312.5	38	17	0.61
Post-traumatic growth	PTGI	12.5 (9.5)	10.8 (11.9)	306.5	38	17	0.54
Perceived social support	MSPSS	59.2 (17.7)	62.8 (17.0)	220.5	37	17	0.04*
Team cohesion	TCF	18.8 (2.5)	17.1 (4.0)	241.0	36	17	0.13
Perceived stress prior to event	Stress	3.2 (1.6)	3.5 (1.8)	284.0	38	17	0.31

*P < 0.05.
** Sample size varied due to missing data,
Cutoff for IES-R "possible" PTSD is a score > 23 and "probable" PTSD is a score > 32. Cutoff for PTGI for "moderate" post-traumatic growth is > 29.
Stress: Degree of perceived stress prior to the event, scored from 1 = "not at all" to 7 = "extremely."
M, median; *IES-R,* Impact of Events Scale – Revised; *PTGI,* Post Traumatic Growth Inventory; *MSPSS,* Multidimensional Scale of Perceived Social Support; *TCF,* Team Cohesion Factor; *Att,* attending physician; Res, resident.

signifying more distress, only one also noted a formal effort to mitigate the impact.

The single-item global assessment of impact on GME was normally distributed and differed significantly between residents and attendings by two-tailed *t*-test ($t = 7.03$, df = 50, $P < 0.01$). Residents reported an overall negative impact with a mean score of 2.53 on the seven-point scale (SD = 1.33), and attendings reported an overall positive impact with a mean of 4.83 (SD = 0.98). A score of 4 on the scale is anchored as "no effect."

Univariate Associations with Peri-Traumatic Stress and Post-traumatic Growth

Table 5 demonstrates the correlation matrix for the standardized scales and the degree of stress prior to the event for all participants (residents and attending physicians combined). Team cohesion correlated positively with the degree of social support. However, this relationship held only among the residents (r = 0.50, $P < 0.05$), not among the attendings (r = 0.10, $P = 0.55$).

Training in Mass Casualty Incidents and Psychological Trauma

Of the residents, 11 (65%) reported some prior training on MCIs, with six (35%) reporting some training on the psychological impact of MCIs on clinicians. Attending physicians more frequently reported some exposure to MCI training (31 of 38 [82%]) and its psychological impact (22 of 38 [58%]). Combining both groups, the average amount of training on MCIs was 2-3 hours with an average of 1-2 hours on the psychological impact. Among residents, IES-R correlated inversely with the amount of MCI training (r = -0.67, $P < 0.01$), and with attendings, IES-R correlated inversely with the amount of training on the psychological effects of MCI (r = -0.39, $P = 0.02$). None of the other ordinal or binomial variables (attended to a patient, witnessed a patient's death, performed death notification, or prior diagnosis of mental health condition) correlated at a statistically significant level with IES-R for residents or attendings. None of the ordinal or binomial variables correlated at a statistically significant level with the PTGI for either residents or attendings.

Univariate Associations with Graduate Medical Education-specific Tasks

Overall, a majority of both residents and attendings reported that the mass shooting had little effect on GME-specific activities. Attendings in particular reported minimal impact, with 94% of responses relating to GME-specific activities reported as "no impact," 2% indicating "negative impact," and 4% indicating "positive impact." Among the residents, 71% of the GME-specific activities were rated as "no impact," 18% as "negative impact," and 11% as "positive impact." Analysis of the distribution of responses revealed that there were outlier participants responsible for the majority of non-neutral responses. Two of the 17 residents (12%) scored, on average, more than two standard deviations above the mean (reflecting that GME activities were much harder). Seven of the 34 attending physicians (21%) who answered all items scored, on average, two standard deviations below the mean (reflecting that GME activities were easier).

The relationship between the overall impression of the impact of the event on GME tasks and post-traumatic growth differed between residents and attendings. Among attendings, the more positive impact they felt the event had on GME tasks, the more post-traumatic growth they reported (r = 0.33, $P = 0.05$). However, with residents this relationship was reversed, although not statistically significant, likely due to the smaller sample size (r = -0.31, $P = 0.23$).

Table 5. Pearson correlation matrix for scales, stress, and general impression of event on graduate medical education.

	IES-R	MSPSS	PTGI	TCF	Stress	General impression
IES-R	1.00	-0.28*	0.50*	0.11	0.28*	0.01
MSPSS		1.00	0.20	0.27*	0.06	-0.12
PTGI			1.00	-0.05	0.13	0.03
TCF				1.00	-0.17	-0.23
Stress					1.00	-0.03

*P<0.05 by Pearson product moment correlation. N=55.
Stress: Degree of perceived stress prior to the event, scored from 1 = "not at all" to 7 = "extremely." General Impression: Scored 1 = "Strongly Negative" to 7 "Strongly Positive" with 4 = "No Effect."
MSPSS, Multidimensional Scale of Perceived Social Support; *IES-R,* Impact of Events Scale – Revised. *PTGI,* Post Traumatic Growth Inventory; *TCF,* team cohesion factor.

DISCUSSION

We sought to determine the potential psychological and educational impact of the worst mass shooting event in US history on members of the GME community who cared for the patients. Consistent with prior literature, most participants, both attendings and residents, reported relatively low levels of post-traumatic stress symptoms five to six months after the event. The vast majority of participants did not intend to either leave medicine or change specialty as a result of this specific exposure to a MCI. Roughly 1 in 10 participants reported symptoms severe enough to be considered PTSD. A previous prevalence screening study of 190 physicians at trauma centers in Texas found a similar rate, with 13% reporting they had previously sought treatment for PTSD-type symptoms.[6] In the Texas study, 16% of ED attendings, 29% of EM residents, and 22% of surgery residents screened at risk for PTSD. Surprisingly, not one of the 15 trauma surgeons screened positive. This is consistent with our current study, which also showed no surgery attending or resident endorsing a level of psychological impact that would suggest PTSD. However, other studies of trauma surgeons have demonstrated a 15% rate of probable PTSD.[19] Thus, it remains unclear whether surgery selects for or develops individuals with a lower risk of PTSD overall or whether social response or selection bias accounts for the lack of surgeons endorsing mental health symptoms in some studies. Importantly, almost all studies used short screening surveys to screen for PTSD, which may overestimate the true rates of clinical PTSD. A study using a survey comprised of the full *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed, criteria found a PTSD rate of 2.2% in physicians.[20]

This suggests that efforts to mitigate the impact of psychologically traumatic events in the GME community should begin with screening to detect those more likely to benefit from additional interventions, rather than comprehensive trauma intervention programs designed for all involved. Most individuals exposed to psychological trauma do not develop PTSD,[21] and early interventions such as mandatory debriefing sessions for all clinicians have not demonstrated efficacy.[22]

Despite the profound potential of the Las Vegas mass shooting to create psychological trauma, we found that few physicians chose to mitigate the impact with help-seeking behaviors. Paradoxically, the few participants who did seek help were not those with the highest reported distress. This inverse relationship between help-seeking and degree of distress is also seen in the depression literature, which has shown that the most distressed individuals are often the least likely to seek help.[23] This pattern has serious implications regarding the typical institutional practice of suggesting to physicians, "If you need help, ask for help." Those who most need help often will not ask.

Regarding GME-specific tasks, the majority of both attendings and residents reported minimal to no impact from the event. Overall, the impact on educational activities was independent of the psychological impact of the event, as evidenced by the near-zero correlation between the IES-R and the global assessment of educational impact. However, residents differed from attendings in their assessment of the educational impact on GME activities. Residents reported the event as negatively impacting their GME experience, while attendings presumably reframed the event as one in which growth occurred. This bias toward growth was seen despite the fact that attendings, far more than residents, correctly recognized the MCI as "outside the normal experience for a physician." Residents may have perceived the MCI as creating a substantial increase in workload. This may have created a work and learning environment perceived as too heavily focused on clinical service vs education. Additionally, residents faced with increased work demands may not have recognized the potential educational impact of the MCI.

Despite reporting similar profiles in overall psychological impact, post-traumatic growth, team cohesion, and perceived stress, attending physicians perceived the impact of this traumatic event on the didactic environment differently than the resident physicians. Some possible explanations may include differences in age, psychological resources, sense of purpose, autonomy, confidence in patient care, or commitment to an organization.

The retrospective assessment of the impact of the event may be a function of the demands placed on the individual and the resources they employ to meet those demands. For example, since residents do not possess a complete skillset and work under supervision, it is possible they may have experienced a greater sense of helplessness, which has been linked to the development of peri-traumatic distress.[24] It is also possible that an MCI may be perceived by certain experienced physicians as an opportunity to demonstrate competency, while for residents such an event may potentially expose weaknesses or knowledge gaps related to their level of training. Although residents did not report greater psychological distress, they did report a more negative perceived impact on their education. Residents' primary developmental goal is professional growth toward independent practice, while attendings have achieved this milestone and are focused on various other objectives. The impact of an MCI appears to disrupt educational goals variably, more frequently for physicians in training, and only for a minority of residents.

Consistent with prior literature, we found that social support was inversely associated with distress. Social support plays a substantial role in overall well-being, as it mitigates depression, encourages work engagement, and buffers stressors in the environment.[25] Deliberate institutional efforts to develop and sustain high levels of collegiality and perceived social support create positive work environments. This likely mitigates the psychological impact of catastrophic events such as the Las Vegas shooting on the healthcare team. Similarly, the association between perceived baseline stress prior to the event and subsequent psychological impact[26] provides a target for institutions hoping to mitigate the impact of a similar event. Broad efforts to improve the workplace environment and lessen perceived stress on the GME community should be supported for many reasons. Our study demonstrates yet another domain in which the high levels of baseline stress can negatively impact GME physicians.

Prior studies have shown a relationship between the risk of PTSD and both a sense of helplessness and the degree of prior training in MCIs.[5,27,28] Consistent with this finding we found an inverse relationship between prior training in MCIs, including training on their psychological impact, and the impact of a traumatic exposure on GME physicians. Institutions should prioritize training in MCIs and the psychological impact of these events as a strategy for mitigating clinician distress. These training events do not require inordinate time commitments. In our study incremental differences of 1-2 hours predicted less psychological distress.

For both cohorts, the degree of psychological impact positively correlated with post-traumatic growth: a relationship noted in prior research in general[29] and specifically among emergency physicians.[30] Post-traumatic growth arises out of the psychological struggle to integrate traumatic events with one's prior understanding of the world. Further research is needed to explore the relationship between psychological trauma and growth in hopes of promoting positive individual development, rather than maladaptive behaviors, after exposure to trauma.

LIMITATIONS

Our research has several limitations. The total number of physicians who actually participated in the care of patients during the Las Vegas MCI is unknown, and thus our survey response rate is unknown. The degree of individual distress may have impacted physicians' willingness to participate in the survey, thereby biasing our study population to reflect a less generalizable cohort. Given that participants self-selected to complete the survey our cohort may suffer from selection bias, as the overall population of physicians who experienced the MCI may differ from those who agreed to participate. Similarly, given the anonymity of the study and the contemporaneous chaos of the event, we cannot confirm that all participants were actually involved in the event other than through their endorsement of being eligible for the study, nor can we determine the extent or nature of the experience of individual participants. While some participants were directly involved in patient care others may have been involved in providing ancillary services such as transportation, logistics assistance, or psycho-social support.

The survey was distributed five to six months following the mass shooting; therefore, participant responses reflect their understanding of the event after contemplation. A follow-up survey to assess trends and possible longer term impact of the event is under development. Typically, disasters create predictable psychological phases of various durations.[31] Initially, the heroic and honeymoon phases last weeks to months and create a sense of social support and hope. The disillusionment phase follows when the realities of the impact of the disaster may be unopposed by the more positive support from the earlier phases. This may last between 3-36 months followed by the final restorative phase. Thus, the timing of our survey likely corresponds with the disillusionment phase; surveys conducted in earlier or later phases may have yielded different results.

Age, which is related to psychological distress and thus can be a confounder, was not assessed to avoid identification of any specific individual's responses. However, the analysis by group (resident vs attending) serves as an imperfect proxy assessment of this variable. Due to the small sample size we did not attempt to compare various specialties to one another in their response to the event. Some specialties, such as the two radiologists who completed the survey, may have had a different level of exposure to trauma than other specialties. However, unlike in routine care, some radiologists came to the bedside during the event to interpret radiographs on portable imaging machines, exposing them to unusual scenes of violence.

Some of the measures, such as the TCF, asked participants about the level of teamwork at the time of the event which could have resulted in recall bias, as residents

with greater or lesser overall impact may have recalled their team cohesion differently. The unpredictability of mass shootings creates significant barriers to any prospective research on the impact of psychological trauma on the GME mission.

Although we asked participants whether they sought psychological assistance following the event, we did not inquire as to the specific type of intervention obtained. Some evidence suggests a differential impact on post-traumatic symptoms depending on the type of psychological approach used; and we could not determine what approaches were employed in our sample population.

Future research on psychological trauma within the GME population may help better characterize the factors that determine the likelihood of an individual developing post-traumatic growth or PTSD symptoms. An examination of why some groups retrospectively view trauma with growth while others view it as entirely negative could yield valuable insights to assist future development of pre- and peri-event interventions.

CONCLUSION

This study of 55 attending and resident physicians involved in the aftermath of the tragic events of the Las Vegas mass shooting found that, months after the event, most physicians reported low levels of PTSD symptoms and minimal impact on GME-specific activities. However, approximately 10% of both resident and attending physicians screened positive for possible PTSD. Attendings and residents differed in their overall global assessment of the impact of the event on their educational mission, with some attendings viewing it as resulting in growth while residents generally perceived it as either neutral or negative.

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The Standardized Letter of Evaluation: How We Perceive the Quiet Student

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Introduction: The Standardized Letter of Evaluation (SLOE) is an emergency medicine (EM)-specific assessment designed to help EM residency programs differentiate applicants. We became interested in SLOE-narrative language referencing personality when we observed less enthusiasm for applicants described as "quiet" in their SLOEs. In this study our objective was to compare how quiet-labeled, EM-bound applicants were ranked compared to their non-quiet peers in the global assessment (GA) and anticipated rank list (ARL) categories in the SLOE.

Methods: We conducted a planned subgroup analysis of a retrospective cohort study of all core EM clerkship SLOEs submitted to one, four-year academic EM residency program in the 2016-2017 recruitment cycle. We compared SLOEs of applicants who were described as "quiet," "shy," and/or "reserved" — collectively referred to as "quiet" — to SLOEs from all other applicants, referred to as "non-quiet." We compared frequencies of quiet to non-quiet students in GA and ARL categories using chi-square goodness-of-fit tests with a rejection criteria (alpha) of 0.05.

Results: We reviewed 1,582 SLOEs from 696 applicants. Of these, 120 SLOEs described quiet applicants. The distributions of quiet and non-quiet applicants across GA and ARL categories were significantly different ($P < 0.001$). Quiet applicants were less likely than non-quiet applicants to be ranked in the top 10% and top one-third GA categories combined (31% vs 60%) and more likely to be in the middle one-third category (58% vs 32%). For ARL, quiet applicants were also less likely to be ranked in the top 10% and top one-third categories combined (33% vs 58%) and more likely to be in the middle one-third category (50% vs 31%).

Conclusion: Emergency medicine-bound students described as quiet in their SLOEs were less likely to be ranked in the top GA and ARL categories compared to non-quiet students. More research is needed to determine the cause of these ranking disparities and address potential biases in teaching and assessment practices. [West J Emerg Med. 2023;24(2)259–263.]

INTRODUCTION

The Standardized Letter of Evaluation (SLOE) is designed to assist emergency medicine (EM) residency programs to differentiate applicants and is considered very important in the decision to interview a candidate.[1] The SLOE includes the applicant's qualifications for EM, a narrative assessment of cognitive and non-cognitive attributes, and the applicant's rank in GA and ARL categories, as compared to other applicants.

We became interested in personality factors that may put an applicant at a disadvantage when we observed less enthusiasm for applicants described as "quiet" in their SLOE narratives. This reaction was consistent with studies showing that being described as quiet on internal medicine clerkship evaluations was interpreted as a negative attribute or "red flag," even when the comment was not linked to performance.[2,3] Further, introverted medical students and residents scored lower than extraverts on subjective clinical evaluations but not on objective assessments.[4,5] Although some studies found extraversion to be related to aspects of success in and outside of medical careers,[6,7] others identified more nuanced measures of personality and non-cognitive attributes to be related to success (eg, conscientiousness,[6,8] emotional stability,[8] and proactivity[9]), qualities possessed by both introverts and extraverts. We found no studies suggesting that quiet individuals were unsuccessful in, or unsuited for, EM careers.

While residency programs strive to reduce bias in assessment and recruitment, there has been little research on how quiet students are perceived or whether a "quiet bias" exists in EM training. We compared the GA and ARL categories in the SLOEs of quiet EM applicants to non-quiet applicants.

METHODS

Study Design

We conducted a planned subgroup analysis of a retrospective cohort study of all core EM clerkship SLOEs submitted to one, four-year academic EM residency program in the 2016-2017 recruitment cycle. We excluded SLOEs from a non-Liaison Committee on Medical Education accredited school, and from students who had graduated from medical school during the application cycle. The study was approved by the institutional review board and the Association of American Medical Colleges.

Study Setting and Population

We compared SLOEs from applicants who were described as "quiet," "shy," and/or "reserved" —collectively referred to as "quiet" — to SLOEs from all other applicants, collectively referred to as "non-quiet." We chose the descriptors "quiet, shy and reserved" because they are typically used to describe introverts.

Study Protocol

The SLOEs were downloaded from the Electronic Residency Application Service into REDCap electronic data capture tools hosted at University of California, San Francisco by JM and de-identified. Demographic information was self-identified by applicants. Gender identification was mandatory while race and ethnicity were optional. Data from SLOEs was extracted by AN and JG and included geographic region of medical school attended, GA (top 10%, top one-third, middle one-third, lower one-third), ARL (top 10%, top one-third, middle one-third, lower one-third, unlikely to be ranked), and narrative comments.

Data Analysis

We used descriptive statistics to describe demographic makeup of the study population with percentages where appropriate. We applied Pearson's chi-square test to compare categorical data using R version 3.6 (The R Foundation for Statistical Computing, Indianapolis, IN) and presented this analysis with *P*-values.

RESULTS

We reviewed 1,582 SLOES from 696 applicants; 120 SLOEs from 107 applicants included the words "quiet," "shy", and/or "reserved" to describe the applicant's personality. The distribution of quiet and non-quiet applicants was not significantly different across race, gender, and geographic region of medical school attended (Table 1). Neither was there a significant difference between quiet and non-quiet students by the gender of the SLOE writer (Table 2).

The distributions of quiet and non-quiet applicants on GA ($P < 0.001$) and ARL ($P < 0.001$) were significantly different (Table 2). For GA, quiet applicants were significantly less likely to be ranked in the top 10% and top one-third categories combined (31% vs 60%) and more likely to be in the middle one-third category (58% vs 32%), compared to non-quiet applicants. Similarly, for ARL, quiet applicants were significantly less likely to be ranked in the top 10% and top one-third categories combined (33% vs 58%) and more likely to be in the middle one-third category (50% vs 31%) compared to non-quiet applicants (Table 2). Finally, we found no difference ($P = 0.66$) in the discrepancy between GA and ARL categories (Table 2).

DISCUSSION

Emergency medicine-bound students described in their SLOEs as quiet, shy, and/or reserved were less likely to be ranked in the top GA and ARL categories compared to non-quiet applicants. We found no differences among relationships between quiet applicants and geographic region of medical school, race or ethnicity, gender, or SLOE-writer gender. At face value, this suggests that quiet students may be perceived as less suited for EM clinical settings than non-quiet students. However, other studies have shown that emergency physicians are a heterogenous group with wide-ranging personality attributes and that this diversity may play an important role in team dynamics.[9,10]

While we did not assess causality, our findings suggest the need to investigate the possibility that teaching and assessment practices in EM training favor the personality and learning style of extraverts, as shown in other clinical settings.[11,12] For example, teaching methods that include interactive-learning, peer-led discussion, and rapid-response

Table 1. Applicant demographic information.

Self-reported demographics	All applicants [n (%)]	Quiet applicants [n (%)]	Non-quiet applicants [n (%)]	Chi-square (P-value)
Total	696	107	589	
Race				
White	354 (51)	50 (47)	304 (52)	0.56
Asian	157 (23)	24 (22)	133 (23)	
Latinx	56 (8)	10 (9)	46 (8)	
Black	48 (7)	6 (6)	42 (7)	
Other	81 (12)	17 (16)	64 (11)	
Gender				
Male	446 (64)	69 (64)	377 (64)	0.92
Female	250 (36)	38 (36)	212 (36)	
Geographic region of medical school*				
Northeast	164 (24)	24 (22)	140 (24)	0.83
Midwest	158 (23)	28 (26)	130 (22)	
South	191 (27)	28 (26)	163 (28)	
West	183 (26)	27 (25)	156 (26)	

*Categorized according to National Inpatient Sample, (https://www.hcup-us.ahrq.gov/db/nation/nis/NIS_Introduction_2010.jsp#figure2)

Table 2. Global assessment and rank list categories for quiet vs non-quiet applicants.

SLOE attributes	All SLOEs [n (%)]	Quiet applicant SLOEs [n (%)]	Non-quiet applicant SLOEs [n (%)]	Chi-square (P-value)
Writer gender				
Male	837 (53)	69 (58)	768 (53)	0.57
Female	550 (35)	38 (32)	512 (35)	
Group	195 (12)	13 (11)	182 (12)	
Global assessment				
Top 10%	325 (21)	11 (9)	314 (21)	<0.001
Top 1/3	599 (38)	26 (22)	573 (39)	
Middle 1/3	531 (34)	69 (58)	462 (32)	
Lower 1/3	127 (8)	14 (12)	113 (8)	
Rank list				
Top 10%	321 (20)	11 (9)	310 (21)	<0.001
Top 1/3	575 (36)	29 (24)	546 (37)	
Middle 1/3	517 (33)	60 (50)	457 (31)	
Lower 1/3	152 (10)	18 (15)	134 (9)	
UTBR	8 (1)	2 (2)	6 (<1)	
No data	9 (1)	0 (0)	9 (1)	N/A
Discrepancy*				
No change	1317 (83)	104 (87)	1213 (83)	0.66
Up	97 (6)	6 (5)	9 (6)	
Down	159 (10)	10 (8)	149 (10)	

*Rank list category changes relative to global assessment (9 SLOEs were missing rank list data).
SLOE, Standardized Letter of Evaluation; *N/A*, not applicable; *UTBR*, unlikely to be ranked.

questioning reward extraverts for assertiveness and allow them to overshadow their introverted peers.[11,12] Consequently, evaluators may unfairly perceive introverts as less motivated, knowledgeable, or prepared, which is reflected in poor performance evaluations.[11] Similarly, assessment criteria that value characteristics of extraverts (eg, initiates and leads discussions) may undervalue the strengths of introverts (eg, synthesizes information, listens before engaging, reflective).[11,12] Medical students who self-identify as introverts report they are aware of the "quiet" bias in medical training and often feel misunderstood and unfairly judged.[12]

Changes to instructional and assessment practices may create a more supportive environment for introverted learners. Instructional changes could include alternating leadership roles, providing reflection time for responses, and offering student-mentorship to help introverts navigate the learning environment.[6,11,12] Assessment changes such as increasing evaluator-student observations, using assessment tools that focus on skill acquisition, and referencing personality only as it relates to performance, may result in more equitable assessment.[5,12]

The ranking disparity identified in this study has high-stakes implications for quiet, EM-bound students who may be at a disadvantage when competing for residency, and warrants further investigation to determine its cause. Examining teaching and assessment practices in the clinical environment may help identify ways to support quiet students in their medical training.

LIMITATIONS

This study has several limitations. We reviewed applications submitted to only one EM residency program, from a single recruitment cycle in 2016, which may not reflect current best practices for writing SLOEs. We did not determine the causality of ranking disparities observed in this study, nor did we assess the contribution of other performance measures such as clerkship grades or board scores. Describing students as quiet, shy, or reserved may not reflect their personality, but rather how they were perceived by their evaluator in the clinical setting in which they were observed. Applicants did not receive a personality inventory nor did they self-report their personality type.

CONCLUSION

Emergency medicine-bound students described as "quiet" in their Standardized Letters of Evaluation were less likely to be ranked in the top global assessment and anticipated rank list compared to non-quiet students. More research is needed to determine its cause and address potential biases in teaching and assessment practices.

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Effects of an Online Community Peer-support Intervention on COVID-19 Vaccine Misinformation Among Essential Workers: Mixed-methods Analysis

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Introduction: Public health efforts to reduce the spread of coronavirus disease 2019 (COVID-19) have been plagued by vaccine hesitancy and misinformation. Social media has contributed to spreading misinformation by creating online environments where people find information or opinions that reinforce their own. Combating misinformation online will be essential to prevent and manage the spread of COVID-19. It is of particular urgency to understand and address misinformation and vaccine hesitancy among essential workers, such as healthcare workers, because of their frequent interactions with and influence upon the general population. Using data from an online community pilot randomized controlled trial designed to increase requests for COVID-19 vaccine information among frontline essential workers, we explored the topics discussed on the online community related to COVID-19 and COVID-19 vaccination to better understand current misinformation and vaccine hesitancy.

Methods: For the trial, 120 participants and 12 peer leaders were recruited through online advertisements to join a private, hidden Facebook group. The study consisted of an intervention and control arm, each with two groups of 30 randomized participants each. Peer leaders were only randomized into one of the intervention-arm groups. Peer leaders were tasked with engaging the participants throughout the study. Posts and comments of only participants were coded manually by the research team. Chi-squared tests assessed differences in the frequency and content of posts between intervention and control arms.

Results: We found significant differences in the numbers of posts and comments focused on topics of general community, misinformation, and social support between intervention and control arms (6.88% vs 19.05% focused on misinformation, respectively, (P <0.001); 11.88% vs 1.90% focused on social support, respectively, (P <0.001); and 46.88% vs 62.86% focused on general community (P <0.001)).

Conclusion: Results suggest that peer-led online community groups may help to reduce the spread of misinformation and aid public health efforts in our fight against COVID-19.
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INTRODUCTION

Misinformation has continued to plague efforts to address coronavirus disease 2019 (COVID-19)[1,2] and exacerbated vaccine hesitancy due to the politicization of COVID-19.[3-5] Social media has been a driver of misinformation, creating environments where people may only find information that reinforces their own.[6-8] Even those in the healthcare field have been affected by this problem,[7,9] but it is important that healthcare workers set an example for the public on scientifically proven options for reducing the spread of COVID-19.[10] The Harnessing Online Peer Education (HOPE) intervention has successfully created attitude and behavior change in multiple locations and medical

conditions,[11-13] and this intervention may be applied to reduce misinformation and promote vaccination. The HOPE tool uses trained peer leaders to help provide support to others online.[11-13]

To better understand the growing problems around misinformation and vaccine hesitancy, we used data from a HOPE pilot randomized controlled trial designed to increase requests for COVID-19 vaccine information among frontline essential workers. In this study we sought to explore the topics discussed on the online community related to COVID-19 and assess differences in conversation topics and frequency between study arms.

Population Health Research Capsule

What do we already know about this issue?
Combating vaccine hesitancy and misinformation online will be essential to prevent and manage the spread of coronavirus disease 2019 (COVID-19).

What was the research question?
Can peer-led online communities reduce COVID-19-related misinformation and vaccine hesitancy?

What was the major finding of the study?
Compared to the control group, the intervention group had less misinformation (6.9% vs 19.1%) and more socially supportive comments (11.9% vs 1.9%, both P <0.001).

How does this improve population health?
The Harnessing Online Peer Education (HOPE) intervention is a promising tool to reduce vaccine hesitancy misinformation and create a supportive community environment.

METHODS

Recruitment

From July 23–August 20, 2021, participants and peer leaders were recruited online to join a Facebook group for a research study. Those who clicked on the advertisements were routed to a screening survey and, if eligible, were called by the study team to verify they were a unique person and friend us on Facebook. Participants were eligible for the study if they were ≥18 years, a US resident, an English speaker, part of phase 1a or 1b of the COVID-19 vaccine rollout (eg, healthcare workers or teachers), and someone who has not received a COVID-19 vaccine. Peer leaders matched participants in eligibility criteria and had initially been vaccine hesitant (when asked, they mentioned a reason they did not want the vaccine) but had eventually received at least the first dose of any COVID-19 vaccine (and showed us a picture of their vaccination card). Peer leaders were also required to attend three virtual training sessions (Zoom Video Communications, Inc, San Jose, CA).

Peer Leader Training

Each session was approximately three hours. Session one focused on background information of COVID-19 and current misinformation. Session two introduced components of communication and various ways of communication online. Stigma and politicization of COVID-19 and how to address these polarizing topics were discussed. Suggested weekly topics were also introduced. We informed peer leaders that the groups were free-flowing and conversations would depend on how participants reacted and interacted with each other. Session 3 focused on the study design. Throughout training, peer leaders participated in group activities to practice using Facebook features and engaging others. After each session, peer leaders were given homework to help reinforce what they learned (eg, post a video about COVID-19 vaccine education).

Intervention

A total of 120 participants were randomly assigned to intervention or control arms. Twelve peer leaders were randomly assigned to an intervention group. Each arm consisted of two private, hidden Facebook groups with 30 participants each. The groups in the intervention arm had six peer leaders each. The four-week study started on August 21, 2021. Twelve participants were later removed from analysis as it was discovered they had been vaccinated before the study began (six from the intervention and six from the control). Participants completed surveys at baseline and post intervention. They were told to use Facebook as they would normally and were also reminded each week that they could request information about the COVID-19 vaccine, including where to receive it. Peer leaders were responsible for reaching out to their assigned participants at least three times per week and completing a tracking sheet that documented which participants they had reached out to and whether there was any response. Each week, peer leaders also met with the study team to discuss questions or problems. Please see references for further details about HOPE studies.[11-13]

Analysis

We manually coded posts and comments from August 21–September 17, 2021. Using a subset of 20 posts, interrater reliability for each category was calculated between the first author and another research associate in the lab to be an average Cohen's $\kappa = 0.59$. Discrepancies were discussed and resolved and the remaining posts and comments were labeled by the first author.[11,14,15] Post or comments could be labeled as follows; "social support" (supportive words to another member); COVID-19 (any topic about COVID-19); COVID-19 facts (scientific facts about COVID-19); COVID-19 misinformation (false or misleading information about COVID-19); COVID-19 experiences (any topic that described a participant's or their family's/friend's experience around COVID-19); COVID-19 opinions (any opinion about COVID-19); COVID-19 questions (any questions about COVID-19); other misinformation (false or misleading

information about a topic besides COVID-19;, misinterpreted facts (referencing an actual COVID-19 fact or research study but arriving at the wrong conclusion), and "general community" (any topic that didn't fit in the other categories) (Table 1). For each category, respectively, Cohen's $\kappa = 0.64, 0.88, 0.62, 0.46, 0.38, 0.29, 0.46, 1, 0.64, 0.50$. Categories were not mutually exclusive. Data were extracted and analyzed by the first author. Only posts or comments made by participants (not peer leaders) were coded and included in the analysis. We used Poisson distribution to assess differences in counts of posts and comments between arms. Chi-squared tests assessed differences in types of posts and comments. All analyses were conducted in Microsoft Excel version 1808 (Microsoft Corporation, Redmond, WA).

Ethics Statement

This study was exempted by the University of California, Irvine Institutional Review Board.

Results

The focus of this analysis was the online conversations. For data about the full intervention, please see our paper about the full study.[12] During the study, there were more posts and comments in the control arm (315 vs 160 in intervention; $P < 0.001$) (Table 2). Most posts and comments

Table 1. Example quotes of each topic. Each topic category is non-exclusive; so, posts and comments can potentially be labeled as all topics. Example quotes were shortened to the relevant text that represented a topic.

Topic	Example quote
General community	Hello! My name is [] and I'm a CNA in Kentucky.
Social support	We would be so hosed without CNAs, ya'll rock!
COVID-19	Now there is talk about a new strain of covid called MU?
COVID-19: fact	Their are several and possibly more to come…the vaccines are waning and/or the new variants can evade the vaccine. Booster shots are planned to start in next few weeks https://www.who.int/.../act.../tracking-SARS-CoV-2-variants/
COVID-19: misinformation	When I start back in the ICU I will be taking ivermectin weekly prophylactically
COVID-19: experience	Looks like my employer is requiring the vaccine by oct 31st now. But I have antibodies still, I've had them since March when I had Covid.
COVID-19: opinion	My body my choice as to what I put in it and when. Period. That is one thing I will never change my mind on.
COVID-19: question	Has anyone been mandated by their employer yet?
Other: misinformation	I believe in the power of herbal remedies too.
Facts misinterpreted	That study shows a great several folds reduction of both infection and symptomatic disease in people with natural immunity. http://www.medrxiv.org/.../2021.08.24.21262415v1.full-text [link goes to a non- peer reviewed study]

COVID-19, coronavirus disease 2019; *CNA*, certified nursing assistant; *ICU*, intensive care unit.

Table 2. Coded conversation topics of participant posts and comments.

Group	1 (%)	2 (%)	Total Intervention (%)	3 (%)	4 (%)	Total Control (%)	Total Intervention vs Total Control P-value
Participant posts + comments (n)	67	93	160	61	254	315	<0.001
Number of reactions	60	137	197	43	142	185	
General community	22 (32.84%)	53 (56.99%)	75 (46.88%)	21 (34.43%)	177 (69.69%)	198 (62.86%)	<0.001
Social support	6 (8.96%)	13 (13.98%)	19 (11.88%)	2 (3.28%)	4 (1.57%)	6 (1.90%)	<0.001
COVID-19	43 (64.18%)	38 (40.86%)	81 (50.63%)	45 (73.77%)	126 (49.61%)	171 (54.29%)	0.45
COVID-19: fact	0 (0.00%)	3 (3.23%)	3 (1.88%)	5 (8.20%)	5 (1.97%)	10 (3.17%)	0.67
COVID-19: misinformation	8 (11.49%)	3 (3.23%)	11 (6.88%)	20 (32.79%)	40 (15.75%)	60 (19.05%)	<0.001
COVID-19: experience	25 (37.31%)	15 (16.13%)	40 (25.00%)	11 (18.03%)	46 (18.11%)	57 (18.10%)	0.08
COVID-19: opinion	21 (31.34%)	23 (24.73%)	44 (27.50%)	15 (24.59%)	73 (28.74%)	88 (27.94%)	0.92
COVID-19: question	3 (4.48%)	6 (6.45%)	9 (5.63%)	3 (4.92%)	6 (2.36%)	9 (2.86%)	0.14
Other: misinformation	3 (4.48%)	2 (2.15%)	5 (3.13%)	0 (0.00%)	7 (2.76%)	7 (2.22%)	0.55
Facts misinterpreted	0 (0.00%)	3 (3.23%)	3 (1.88%)	4 (6.56%)	4 (1.57%)	8 (2.54%)	0.65

COVID-19, coronavirus disease 2019.

were about COVID-19 in both the intervention and control arms (50.63% and 54.29%, respectively) (Table 2). We found significant differences in the amounts of general community, misinformation, and social support between arms. Misinformation was 6.88% of participant posts and comments in the intervention and 19.05% of participant posts and comments in the control (P <0.001) (Table 2). Social support was 11.88% of participant posts and comments in the intervention arm and 1.90% of participant posts and comments in the control arm of the study (P <0.001) (Table 2). General community was 46.88% of participant posts and comments in the intervention and 62.86% of participant posts and comments in the control arm (P <0.001) (Table 2).

For the intervention arm, 33 participants were engaged (defined as reacted, commented, or posted) in week one, 29 in week two, 11 in week three, and 21 in week four. For the control arm, 30 participants were engaged in week one, 15 in week two, 16 in week three, and 7 in week four.

DISCUSSION

As demonstrated by the decreased amount of misinformation in the intervention vs control group, results suggest that HOPE has the potential to reduce misinformation in social media groups with peer leaders. While this study looked to address COVID-19 vaccine misinformation, HOPE could be adapted to address misinformation for other public health issues. This has immediate public health implications as it can be used to both combat misinformation and disseminate information during public health crises.

LIMITATIONS

Limitations include small sample size and short study duration. Our previous studies that used this intervention generally operated for 12 weeks. Neither the intervention nor control group participants posted much about facts, and what was posted was generally misinterpreted. This may be due to the peer leaders being the ones generally posting factual information. The short duration may also have been a factor in what participants could learn during that time. Future studies might explore ways to increase conversations about factual information.

There were also more posts and comments made by participants in the control group. This may be due to one outlier in group 4, who posted heavily (approximately 170 posts and 80 comments, which is more than the total of groups 1-3 combined). While this participant was later one of the ones removed from analysis, other people's comments on their posts remained in the analysis. It is difficult to know whether the reduced misinformation in the intervention groups may have been due to them not wanting to post as much in groups with peer leaders. Past HOPE studies have found the intervention arm to generally have more posts and engagement compared to the control group,[11,15] making it of interest to explore reasons for the control group having more in this study. Recruitment also targeted people who use Facebook and were employed as a frontline essential worker. This demographic may not necessarily represent the general population.

CONCLUSION

Overall, results suggest that peer-led social media groups can be a powerful tool to help combat misinformation online and aid in addressing public health needs. Peer leaders can help shape the social norms within the group, reduce the spread of misinformation, and create a supportive community environment.

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Emergency Medicine Residents' Perceptions of Working and Training in a Pandemic Epicenter: A Qualitative Analysis

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Introduction: We sought to describe the range of emergency medicine (EM) resident physicians' perceptions and experiences of working and training during the initial coronavirus 2019 (COVID-19) pandemic surge at two, large-volume, urban training hospitals in Brooklyn, New York.

Methods: A total of 25 EM resident physicians who worked at either of two large emergency departments (ED) from March 15–April 11, 2020 participated in semi-structured interviews conducted in July and August 2020. Interviews were conducted by the authors who were also emergency medicine resident physicians working in the ED during this time. We asked open-ended questions to residents about their experiences and emotions at work and outside of work, including their relationship with co-workers, patients, and their community. The interviews were audio-recorded and transcribed. We then conducted a thematic analysis to identify, classify, and define themes from interview transcripts. Iterative commonalities and differences between interview response themes were grouped to create a broadly applicable narrative of the residents' perceptions and experiences of working and training during this initial wave of a novel pandemic. Interviewees also responded to a demographics survey.

Results: Study participants described four major aspects of their perceptions and experiences of working and training during the stated time, including emotional challenges such as anxiety and feeling underappreciated; protective thoughts, including camaraderie, and sense of duty; workplace challenges such as limited knowledge surrounding COVID-19 and a higher volume of acute patients; and adaptive strategies including increased communication with ED administrators.

Conclusion: Emergency medicine residents have a unique perspective and were key frontline hospital responders during a prolonged disaster and mass triage event within a local health system. Considering the chronic case and mortality fluctuations and new variants of COVID-19, as well as the anticipation of future infectious disease pandemics, we believe it is important for key decision-makers in resident education, hospital administration, and all levels of public health management to inform themselves about residents' emotional and workplace challenges when establishing hospital and residency program disaster protocols. [West J Emerg Med. 2023;24(2)269–278.]

INTRODUCTION

On March 11, 2020, the same day that the World Health Organization declared coronavirus 2019 (COVID-19) a pandemic, New York City (NYC) had its first confirmed COVID-19 associated fatality.[1,2] According to the US Centers for Disease Control and Prevention, from February 29–June 1,

2020 there were 203,792 confirmed diagnoses of COVID-19 in NYC. Of those patients with confirmed diagnoses, 54,211 were hospitalized and 18,679 died.[3] Hospital admissions peaked in NYC the week of March 29, with a mean of 1,566 admissions/day. Deaths peaked in NYC the week of April 5 with 566 deaths/day.[3] The increase in hospital admissions and emergency department (ED) visits placed increased stress on an already strained healthcare system and clinicians.

Prior qualitative research has reported on the healthcare worker experience during pandemics and natural disasters. These studies have primarily focused on the psychological wellbeing of staff exposed, the healthcare worker experience, and the attitudes and willingness of healthcare workers toward coming to work.[4-8] In 2016, a systematic review was published looking at 111 papers to understand steps that can be taken at all stages of a disaster (before, during, and after), which may minimize risks to responders and enhance resilience including preparedness and support.[9] However, there has been limited research published focusing specifically on postgraduate trainees' perceptions of their experience working, learning, and living through any pandemic, including COVID-19. In fact, although thousands of papers have been published between 2020-2021 regarding COVID-19, only a handful were qualitative studies.

There has yet to be published participant observation research exploring the details of resident experience early in the COVID-19 pandemic with significant depth. This is likely due to time constraints; however, in doing so, this has "[hindered] the exploration and portrayal of complex human and social phenomena and therefore [produced] less credible findings due to short-term immersion between the researcher and participants."[10] In this paper we explore emergency medicine (EM) residents' perceptions of working and training during the first wave of the COVID-19 pandemic in two urban hospitals using participant observation, where investigators had been completely integrated into the study population beforehand. The information from this study can be used by EM residents, residency directors, hospital administrators, and emergency preparedness professionals to help hospitals, residency programs, and residents/trainees globally prepare for future pandemics, and natural and/or manmade disasters.

Population Health Research Capsule

What do we already know about this issue?
Recent qualitative research describes negative emotions and interpersonal relationships of emergency medicine (EM) residents working outside the US during the coronavirus disease 2019 (COVID-19) pandemic.

What was the research question?
What were EM residents' perceptions and experiences of working and training during the initial COVID-19 pandemic?

What was the major finding of the study?
EM residents have a unique perspective during prolonged disaster and mass triage events within a local health system.

How does this improve population health?
The results from our study will help hospitals, residency programs, and residents/trainees globally prepare for future pandemics, and natural and/or manmade disasters.

METHODS

Study Design

The authors (excluding TS, the principal investigator [PI]), were EM resident physicians working in the ED during the dates of interest and at the time interviews were conducted. We interviewed EM residents who worked primarily at one public urban, safety-net, large-volume Level I trauma center and/or at a separate tertiary care center designated as a COVID-19 only facility. The PI was an attending emergency physician at the study sites during the dates of interest and at the time interviews were conducted. These hospitals saw an influx of patients during a time when New York City was described as a COVID-19 epicenter during the first wave of the COVID-19 pandemic in the US.

We conducted a thematic analysis of interview data using qualitative methodology to bring out rich and meaningful narratives of this group's experiences during dates of high utilization of emergency medical services.[11] We selected and finalized the study design, including utilization of interviews, the interview content, timing, and analysis, for the purpose of identifying a range of themes de novo, centered around EM resident perceptions and experience of working and training during the initial COVID-19 pandemic surge at two, large-volume, urban training hospitals in Brooklyn, NY. Our academic institution's institutional review board (IRB) approved the study. No conflicts of interest were identified in the IRB approval process.

Participants

A total of 25 EM residents took part in one-on-one, semi-structured interviews conducted in July and August 2020. Two of the primary authors, junior residents in the residency under focus, recruited participants by emailing all residents who met inclusion criteria, informing them about the nature and purpose of the study. The recruitment information requested that all residents not interested in participating opt out and that participation was voluntary. The primary investigators involved in the study's development were excluded from the study. Those interested in participating enrolled to participate

in an interview. Of 97 EM residents in the 2019-2020 academic year, 73 met inclusion criteria, having worked at either urban hospital's ED site between March 15, 2020-April 11, 2020 for at least one shift. The study's authors were excluded from selection. Residents who met inclusion criteria were sorted by postgraduate year (PGY) class for the 2019-2020 academic year and into EM and EM/Internal Medicine (IM) combined residency (EM/IM) and subsequently randomized. We refer to these participants (both EM and EM/IM residents) as "emergency medicine residents" in this manuscript.

Sampling

We recruited a purposive randomized representative sample of residents to participate, excluding those who did not work in the primary EDs, mentioned prior, during these dates or were involved in the study's design. Of the 73 residents who met inclusion criteria, 25 were asked to participate. These 25 were selected by an online randomization tool that identified four random participants from each EM class, and one random participant from each EM/IM class. One PGY-1 EM resident declined to participate after randomization, and another resident who met inclusion criteria was randomly selected for that group. There was a total of 25 participants, broken down into five participants for each EM PGY class 1-4 and one participant for each EM/IM PGY class 1-5. We reviewed the list of interviewees prior to interviews by the investigators prior to interviews, and the sample was judged to be a sufficiently diverse (age, gender, ethnicity, hospital site, duration of time worked, and educational background) representation of the residency classes involved in the study.

Survey and Interviews

Study participants responded to a demographics survey emailed to participants and administered via Google Forms. Individual interviews took place and confidentiality was ensured before the interview began. Additionally, the participant gave verbal consent before beginning the interview. Interviews were conducted by the four EM resident physician authors and excluding the PI/last author. The investigators had prior academic experience and training conducting qualitative interviews. Interview transcripts were reviewed weekly to assure quality and consistency of experience and data acquisition and to identify and correct any deviation. Interviews were 30-70 minutes long. The broad range of interview duration can be attributable to depth or brevity of participant responses despite two to four probing questions per core question. Interviews took place using online video platforms, Zoom and Google Meet. All interviews were audio-recorded and transcribed verbatim using the automated audio transcription software, Descript, (San Francisco, CA) and then corrected manually by the investigators.

All interviews followed the structure set out in the interview guide (Supplemental Materials), with minor iterative changes as interviews progressed. Generally, interviews began with "how are you feeling?" or "how has work been" as general ice-breaker questions. The subsequent question asked the subject to discuss their experiences working in the ED prior to COVID-19 peak dates, followed by an open-ended question: Describe working in the ED during the last two weeks of March and the first two weeks of April 2020. Subsequent questions asked the subject to describe their relationship with patients, ED administrators, ED attending physicians, other ED staff, and co-residents during the focus dates.

For the final 10 interviews, there was, at this point in the interview, a question about what was on a subject's mind while arriving to shift and/or a question about home life during these focus dates. Residents were asked to describe the actions, if any, that were initiated in the workplace and the residency program for the purpose of quality improvement or wellness during the focus dates. Residents then were given the opportunity to add or clarify anything, and the interview concluded with a question about what advice the interviewee subjects would give to other residency program leadership and/or EM residents who found themselves in similar situations in the future. For each of these questions, the interviewers probed the interviewee if a response needed more clarification, elaboration, or examples.

Data Analysis

Demographic survey data was analyzed via Microsoft Excel (Microsoft Corporation, Redmond, WA). We analyzed interviews using the qualitative analysis software MaxQDA (Verbi, Berlin, Germany), tallied conceptual themes mentioned by our participants, and consolidated and deduced from participant responses our general and evolving questions surrounding their experience in the ED during the first wave of COVID-19 in the US. Themes were derived from participant responses to emotion-neutral and opinion-neutral questions about workplace and out-of-workplace relationships and EM medicine trainee experiences during a prolonged disaster and mass triage event lasting approximately four weeks.

Themes found in the transcripts of the interviews were initially subdivided into the following primary categories: workplace challenges; adaptive workplace strategies; emotional challenges; and positive thoughts and resilience (later renamed protective thoughts), based on a consensus by the investigators to categorize what participants chose to discuss in their interview responses. The primary categories of relationships, clinical learning, and wellness activities were initially created inductively, as participants were asked to speak on these topics with open-ended, emotionally neutral questions. These categories were further divided into their final sub-thematic codes based on how participants chose to focus their answers to these questions.

When creating themes based on the spoken details of our interviews, we combined conceptually equivalent themes. This was true of sub-themes within all primary categories. For example, when transcript segments described

the challenging emotions of "feeling unprepared," "feeling overwhelmed," or "feeling powerless" to describe the patient care experience, we initially coded these separately but ultimately combined these themes and recoded the transcript segments under the new theme: "Unprepared, overwhelmed, and/or powerless." We maintained themes that were mentioned by greater than 10% of our informants. After an iterative review of theme names, thematic code definitions, and document transcripts, interrater reliability was good (Cohen's kappa [k] = 0.82.). While the primary categories of relationships, clinical learning, and wellness activities were initially created, authors found that the relationships were not brought up as a primary theme of discussion by participants but rather brought up as subcategories of examples in the context of the major themes presented.

RESULTS

Study Participant Demographics

We interviewed 25 residents with multiple dimensions of demographic diversity (see Table 1). There was a total of 25 participants, broken down into five participants for each EM PGY class 1-4 and one participant for each EM/IM PGY class 1-5. Of those, 13 identified as women and 12 identified as men.

Table 1. Respondent demographics

Demographic	Percentage (%)
Gender	
Female	13/25 (52%)
Male	12/25 (48%)
Age	
27-30	11/25 (44%)
31-34	11/25 (44%)
35+	3/25 (12%)
Relationship status	
Single	6/25 (24%)
In a relationship	19/25 (76%)
Living situation	
Alone	4/25 (16%)
With others	21/25 (84%)
Ethnicity	
African American	3/25 (12%)
Asian	4/25 (16%)
Caribbean	1/25 (4%)
White	9/25 (36%)
Latino	1/25 (4%)
South Asian	4/25 (16%)
Middle Eastern / North African	1/25 (4%)
Mixed (including AA/Latino, Asian/AA)	2/25 (8%)
PGY Level	
1	6/25 (24%)
2	6/25 (24%)
3	6/25 (24%)
4	6/25 (24%)
5	1/25 (4%)
Program	
Emergency Medicine (EM) Categorical	20/25 (80%)
EM/Internal Medicine (IM) Combined	5/25 (20%)
Sick with COVID	
Yes	13/25 (52%)
No	12/25 (48%)

COVID, coronavirus disease 2019.

Emotional Challenges and Protective Thoughts

Emergency medicine residents recalled experiencing a wide range of challenging and protective emotions and thoughts related to their work environment. (See Figure 1 for a diagram of these themes and Figure 2 for a sample of quotes in these categories; a complete codebook of themes, definitions, and representative quotes can be found in the Supplemental Materials.) Challenging emotions included the following: feeling stress, fear and anxiety; frustration and anger; feeling underappreciated or dispensable; feeling unprepared, overwhelmed, or powerless; feeling trapped or unable to escape COVID-19; feeling humble or resistant to praise; feeling lonely, isolated, abandoned, misunderstood or excluded; feeling sad or depressed, feeling remorseful or guilty of personal decisions; feeling burned out, morally distressed, exhausted, apathetic, or numb; and feeling post-traumatic stress or secondary trauma.

Positive, protective, or resilient emotions and thoughts included the following: feeling inspired or proud of colleagues; feeling relieved by getting sick or wishing to get sick to avoid worrying about it; feeling appreciative or surprised in a positive way by certain outcomes; being able to find learning opportunities; feeling a sense of camaraderie or teamwork; feeling proud to work or a sense of duty; accepting of reality; feeling hopeful or optimistic; feeling empathetic toward patients or their families; identifying strategies for self-care; identifying sources of emotional support; feeling well-prepared, confident, or trusting of one's self; feeling supported by the community; and finding ways to feel useful or helpful by being flexible with roles in the workplace or coordinating wellness activities and response efforts.

Workplace Challenges and Adaptive Solutions

Emergency medicine residents were faced with the following workplace-related challenges: difficult patient and family discussions; limited knowledge surrounding COVID-19 pathophysiology and evolving recommendations and protocols; higher volume of patients arriving in the ED with more severe acuity; challenges to transparency of administrative decisions; shortage of hospital resources, including supplies and staff, further exacerbated by the

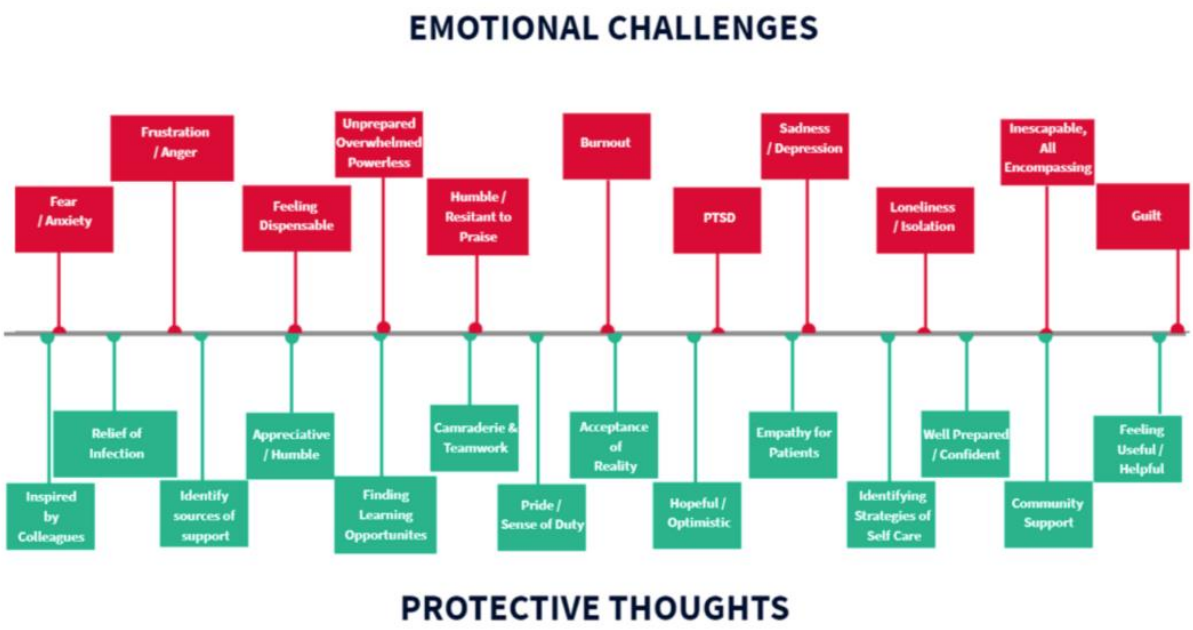

Figure 1. Diagram of a range of emotional challenges and protective thoughts of 25 emergency medicine resident physicians regarding working and training during the first wave of the COVID-19 pandemic in two urban US hospitals, 2020.
COVID-19, coronavirus disease 2019; *US,* United States.

"It made me really ***sad and angry that I wasn't able to do anything***. There was one specific case that I remember, someone who was actually one year younger than me, who came in and his only medical problem was asthma. Initially, he was talking. He looked like he was in a little bit of respiratory distress, but he was talking to us, became a little bit confused, and literally within hours of taking care of him, he codes. We intubated him and everything. ***We tried to do everything that we possibly could.***"

Frustration and Anger

"Not being able to hang out with friends in the same way as the first year of residency: you have a stressful shift; everyone develops different ways to cope with that. And for me, it was definitely social. That was definitely one way of coping was to get away and hang out with friends who are not in medicine or hanging out with the girlfriend or see family. ***So not really being able to do that, it's another facet of why it was a difficult time***."

Loneliness/Isolation/Abandonment

"I came in prepared, but it ***felt like a war zone*** simple, right? It felt almost like you see the movies, you know with the silly alarm sounds going off in the background all the time and people rushing around it, hallways are lined with patients. Everybody's on some sort of breathing assistance, whether it's supplemental O2 or PEEP. You can't see patients cause the whole place is full of people that are, they're sort of acquiring a lot of oxygen. I think I'm a somewhat competent doctor. ***What I'm seeing just didn't make sense within the paradigm of what I knew of medicine***, and I just did not know how to approach it."

Unprepared, Overwhelmed & Powerless

"At a certain point, I was like yes. I've tried to let as many people know how crazy this is and know how important it is to be smart, safe, socially distance and to protect yourself with appropriate PPE and all that. Now, it's like ***I can't go crazy every time I see somebody who's not doing that***. That's just not healthy for me. It shifted from a sort of crazy, almost, hero-complex trying to tell everyone and inform everyone to just live at this point where whatever happens is going to happen. That's just life, unfortunately. I think that's where I am currently. People know what it is now and know what they need to do now, and if they don't do it, then I'll be there for them. ***If they end up in the ER, I'll do the best I can to take care of them, but that's the most I can do at this point.***"

Acceptance of Reality

"I think, for a lot of our attendings and administrators, they were mentioning that they have never been through a pandemic like this before and this is a once in a lifetime pandemic. We were feeling unknowledgeable and not understanding the pathophysiology of this disease, but trying to figure out all the treatment options, trying to make sure our loved ones were safe, and we were safe. ***We were able to share those emotions and comfort each other in those times***, and make sure that we all felt that we were in this together, that no one was going to be left behind. We made sure that every one of us in the department felt supported: ***that we were going to come out of this stronger and closer as a family***."

Camaraderie / Teamwork

"I definitely saw that from other residents too, so that it was just kind of like a positive feedback loop because ***other people were so willing to lend helping hands or provide assistance wherever it needed***. I also wanted to do that. It definitely became just a more ***sense of duty than anything else, for better or worse***. I don't know how good that was for peoples psychologically, but I think it was nice to kind of feel like ***we were all just a team and a family*** working together to just try to stay afloat and get through this together."

Pride in Work / Sense of Duty

Figure 2. Quotations describing the emotional challenges and protective thoughts of 25 emergency medicine resident physicians regarding working and training during the first wave of the COVID-19 pandemic in two urban US hospitals, 2020.
COVID-19, coronavirus disease; *US,* United States.

pandemic; witnessing frequent death and dying patients; managing admitted or boarding patients in the ED; social determinants of health; patient presentations limited to COVID-19 and its complications; death and illness of colleagues as well as illness of the interviewee; transitioning from the work to the home environment. (See Figure 3 for a diagram of these themes and Figure 4 for a sample of quotes in these categories.) A complete codebook of themes, definitions, and representative quotes can be found in the Supplemental Materials. Of note, the order and layout of the ranges of responses in Figures 1 and 3 are not arranged with a particular hierarchy but rather are meant to graphically display all major themes found in at least 10% of interviews.

Residents recalled several approaches that the residency program, ED, and hospital administrators took to address workplace challenges, including the following: limiting Covid-19 exposure through a no-visitor policy; establishing hot and cold zones in the ED; policies initially barring residents from participating in aerosolizing procedures; and personal protective equipment (PPE) protocols. Other workplace strategies included city-level, hospital-level, and physician-level decisions not to intubate certain patients or perform cardiopulmonary resuscitation because of medical futility or risk to staff. One of the hospital's responses to increases in patient volume and acuity in the setting of a worsening shortage of resources was to increase staffing through Federal Emergency Management Agency and US military healthcare workers.

Other department- and residency-level policy implementations included intentional visibility and communication availability with ED administrators, formal and informal debriefing sessions, enforced breaks and days off, procuring tablets and other devices to facilitate family and patient conversations, and residency didactics via the Zoom virtual meeting digital platform. Finally, residents and attending physicians designed and implemented hourly oxygen saturation monitoring rounds, while attending physicians worked with ED administrators to streamline and discharge hundreds of ambulatory, non-hypoxic patients from triage or the waiting room.

Resident-Focused Wellness Activities

While some residents mentioned residency specific activities created for the purpose of resident emotional well-being during this period without prompting, many residents responded to questions that asked them to specifically comment on resident-focused wellness activities or quality improvement interventions, resident education, as well as offered advice they might give to other residency programs. Emergency medicine residents were appreciative of wellness activities and found them to be a source of emotional support. Specifically, they felt supported by the community and appreciative or proud of their co-resident colleagues for procuring meals, PPE, gift bags, and other donations. They appreciated Zoom hangout sessions with their co-residents and scheduled days off.

Resident Training and Education

Residents recalled their training and education during this period. They mostly cited experiential or self-directed learning. They also mentioned limitations in their training by the challenges of lack of patient presentation variety, with most of their patients having some degree of COVID-19-induced hypoxic respiratory failure or COVID-19-induced diabetic ketoacidosis. Although never formally coded, a few residents did mention that this monotony had affected their overall training, but that perhaps the benefits of working during a pandemic outweighed the shortcomings, and that they felt that they would fill this knowledge gap either during the remainder of their residency or afterward. Residents reported learning from their co-residents, including bedside training on how to make an innovative medical device using existing hospital supplies such as ventilator tubing, a bilevel positive airway pressure mask, a viral filter, and a positive end-expiratory pressure (PEEP) valve or a canister of water, for the purpose of providing PEEP during periods when respiratory and oxygenation-assisting devices were lacking in the hospital.

Junior resident oversight and bedside teaching by senior residents and attending physicians was a challenging aspect of resident education, due to limited knowledge and evolving protocols surrounding COVID-19 and a higher volume of higher acuity patients. However, junior residents felt supported by their senior residents and attending physicians who saw a large volume of patients and offered emotional debriefing, rather than focusing specifically on bedside teaching. Education and emotional well-being were promoted by Wednesday morning didactic conferences and daily morning report, which were eventually moved to the Zoom virtual meeting software platform and sometimes included resident-initiated group talk therapy and reflection.

DISCUSSION

Key Findings

A major objective of this exercise was to develop a comprehensive narrative of a prolonged traumatic shared experience faced by EM residents during the dates recalled as the first wave of the COVID-19 pandemic at two urban hospitals in a US epicenter. The purpose was to provide future EM residency program leadership and residents with this insight to prepare for and manage similar future unexpected pandemics or other prolonged disasters and mass triage events. Key informant interviews took place 3-4 months following this period and EM residents recalled and discussed several major aspects of their experience working and training during these dates of peak patient volume and acuity. Interview questions focused on the general experience, but also specifically on education, interpersonal relationships, and resident-focused interventions within the training program. Major themes

Figure 3. Diagram of a range of workplace challenges and adaptive workplace strategies experienced by 25 emergency medicine resident physicians when working and training during the first wave of the COVID-19 pandemic in two urban US hospitals, 2020. *COVID-19,* coronavirus disease 2019; *US,* United States.

"I think the main ethical dilemma was to ***continue care for someone who may not benefit from that*** and you might actually just be suffering. It was really tough having those [goals of care] discussions with family members and really helping them understand the outcome. Just making the call to intubate them or not and ***when to just decide, kind of say no***. I'm not going to do it."

Challenging Patient Interactions

"Morning reports shifted from being educational, to being more about talking and letting out, whatever thoughts were on our minds. ***Attendings created safe spaces for people to communicate their thoughts, fears, anxieties***. Little financial gifts and masks early on when you weren't guaranteed to be there every day. Making it known that they're available for residents to talk. ***I felt like we had a good network of people above us***."

Debriefing

"When patients would come into the ER, their family members weren't there. If it was someone who's elderly or could not make decisions for themselves, you'd have to have these conversations with families on the phone about what will likely happen, what we can offer, what we can't offer, and what the alternative is: ***to go back home exposing usually multi-generation families in one home***, but letting their matriarchs and patriarchs live out their days in the comfort of family, as opposed to being marooned in a room that maybe gave them some medicine, ***but that certainly wasn't what our standard of dying with grace and dignity had been prior to that.***"

Limiting COVID Exposure

"I ***was pretty defeated***, honestly. I come home after seeing at least one person die per day, if not more than that. I recently was talking about it with my fiancé. Every single day it was so dark, coming home and telling him what happened at work. I'd just be like, "Oh, I saw this person die". I had to tell this family member that their loved one died. I coded this person for this long. It was kind of defeating- ***you just realize nothing you're doing is changing anything***."

Witnessing Frequent Death and Dying

"Everyone coming in desaturating to the seventies requiring 15 liters of oxygen to maintain even minimal saturations and still tachypneic. Even though the overall volume in the ED had dropped drastically, ***the acuity of the patients that you were seeing had skyrocketed***. Shortly after, we ran out of BiPAP machines and then it was kind of the wild west of medicine. We created or own little C-PAP mask. and then when we run out of the PEEP valves that were necessary for a C-PAP mask, we created a water C-PAP: ***anything at all to try and keep these patients breathing***."

Oxygen Saturation Monitoring / Hypoxia Rounds

"I think you're seeing how sick some of the early COVID patients could get and then realizing: okay, if we saw a lot more of these patients, we would ***run out of resources really quickly***. I think there's just the idea that things were . . . gradually getting worse and worse, and ***we didn't know how bad they would get***."

Shortage of Resources

Figure 4. Quotations describing the workplace challenges and adaptive workplace strategies experienced by 25 emergency medicine resident physicians when working and training during the first wave of the COVID-19 pandemic in two urban US hospitals, 2020. *COVID-19,* coronavirus disease 2019; *US,* United States.

emerged: 1) EM residents recalled several workplace challenges; 2) adaptive workplace strategies to address these challenges, as well as their own 3) challenging or 4) protective interpretation and emotional response to these challenges.

In summary, this was a very complex and unanticipated situation for these EM residents as they faced the uncertain morbidity and mortality stemming from the COVID-19 illness, at a time when there was limited knowledge of its pathophysiology, method and likelihood of transmission, patient risk factors, and predicted duration of the pandemic. Emergency medicine residents working at these urban hospitals in a COVID-19 pandemic epicenter during the initial peak volume and acuity dates of the COVID-19 pandemic knowingly risked their lives as they watched countless patients and some of their own colleagues, including attending physicians, nurses, and patient care technicians, become ill and die. They had countless difficult patient and family conversations, and they made ethical decisions brought about by medical supply and staff shortages in a healthcare system that was quickly and unexpectedly overwhelmed by a high volume of sick patients. Residents were often unaware of reasoning and considerations behind administrative actions and behind local, state, and national public health policies, often receiving conflicting messages.

Prior to the pandemic, residents had already been addressing disease outcome inequities caused by social determinants of health, including chronic staffing challenges already existing in these hospital systems. With the increased patient volume and acuity during these COVID-19 peak dates, they also faced an acute shortage of oxygen canisters, ventilators, PEEP devices, high-flow nasal cannula machines, negative pressure rooms, general bed capacity, and PPE. Residents inevitably had to manage admitted patients on behalf of overwhelmed inpatient teams. Their participation in medical education was limited by a lack of variety of patient presentations, and they had difficulty transitioning from their work environment to their home environment.

Some of these challenges were addressed by administrative policies and resident wellness activities. Despite these interventions, EM residents faced difficult emotions: they felt exceedingly fearful, anxious, sad, overwhelmed and powerless, unappreciated or undervalued, lonely and isolated, and burnt out, and often demonstrated post-traumatic stress responses. However, with the help of workplace and outside of work emotional support, residents were able to adapt and display evidence of their emotional resilience, appreciate their colleagues and community support, and persistently show empathy for their patients. They found ways to feel useful, were hopeful, and accepted aspects of a new reality. They felt inspired by and supported by their workplace teammates, were proud of their work, and maintained a sense of duty to provide patient care to the best of their ability.

Comparison To Previous Research

There have been several perspective and commentary pieces written by training program leadership outlining the measures taken during a disaster period to address residency training challenges.[12-14] They comment on the need for providing clear communication from leadership, establishing resident wellness committees, and guaranteeing PPE and the measures taken to do so. A commentary by chief residents of a medical training program on adaptive strategies applied at work highlights the application of scheduled updates and communication from residency leadership, and the creation of a space for debriefing and maintaining emotional connections between coworkers through online conferencing.[14] One participatory observational study looking at residents' perceptions of their education during the COVID-19 pandemic found that residents felt their didactic education time and their attendings' involvement in formal education decreased.[15]

Our study is the first to analyze the emotional and workplace challenges and perceptions along with the adaptive and protective strategies employed by postgraduate medical trainees and the training program in a pandemic or disaster period. While these previously cited papers individually recollect what interventions were undertaken by residency leadership, ours delves into the breadth of the workplace *and* emotional challenges that were encountered. Our study also provides participant-informed feedback on implemented adaptive strategies, experienced protective factors, and suggestions for future pandemic and disaster response scenarios.

LIMITATIONS

Specific approaches were taken to reduce some of the limitations commonly found in qualitative analyses. Measures were taken to have a diverse pool of participants; however, accuracy of participant representation of each class and the entire residency program was not measured quantitatively but rather subjectively by all authors. (See Table 1 for some diversity data.) A potential limitation was that all residents worked in an urban setting; therefore they were not necessarily representative of rural or suburban communities. Further, the accuracy and relevance of some perspectives may vary based on the participant resident's level of training and their likelihood of having acquired knowledge and experiences such as coping mechanisms and comfort with end-of-life discussions.

While residents were asked during their interview not to share the content of interviews with any other resident, this may have still occurred, and may have potentially biased some responses. While confidentiality was agreed upon prior to interviews, there may have been some hesitation for informants to speak with complete candor for an interview discussing their experience, possibly limited by a perception that administrators may not have wanted them to be completely transparent surrounding perceived challenges or

failures. In a complex traumatic event, the experiences of residents are expectedly iunique, dynamic, time-limited, and subject to memory-related biases. The willingness to partake in a qualitative interview with the primary investigators may potentially correlate positively with satisfaction surrounding administrative interventions related to COVID-19, although only one recruited EM resident refused to participate. Participants may have felt compelled to participate given their knowledge that senior EM residents and an EM graduate medical education administrator formed part of the research team.

While theme saturation was achieved for the thematic categories, only 25 residents were sampled; therefore, identified themes may not be an exhaustive list of perceptions an EM resident may experience when faced with a prolonged disaster environment. While final theme creation and selection may have been biased by investigators' membership within and shared experiences with the group under study, we believe these study outcomes represent a sufficiently broad and nearly comprehensive range of possible experiences and perceptions.

The dates we focused on were chosen by our PIs, who were participant observers in relation to the population under study, with a level of complete participation in activities of the group under study, also having worked clinically in these EDs alongside the participants during the focus dates and prior to the initiation of the interviews. There was a consensus among the investigators that the most noticeably challenging dates for COVID-19 at our hospitals, coinciding with the highest number of high-acuity COVID-19 patients compared to other dates, were March 15–April 11, 2020. Therefore, the interviewers repeatedly focused and refocused interview questions on these dates. However, it is possible that focusing on a longer period or asking generally about experiences during the first pandemic waves may have had the potential to yield a more comprehensive exploration of residents' experiences related to the disaster and mass triage period under study.

CONCLUSION

This study demonstrated that EM residents have a noteworthy perspective as key frontline hospital responders during a prolonged disaster and mass triage event within a local healthcare system. For example, many residents mentioned that there were informally enforced breaks with food delivery and how this created a space to step away from the clinical area as well as spend time to talk to and receive emotional support from colleagues. Further studies to examine the effect of enforced breaks on wellness/emotional well-being may be indicated from these findings.

Furthermore, residents mentioned positive interactions with administrators during daily briefings. Further study is indicated to see the benefits, if any, of formal briefing as a policy. Key decision-makers in health system administration and emergency preparedness should consider protocolization of treatment plans and conversations regarding end of life. Implementing supervision quality checks of these difficult do not resuscitate/do not intubate conversations may allow junior residents real-time feedback. Asking supervisors to enforce and encourage breaks during working shifts, having a formalized and enforced PPE policy, as well as having readily available or on-site access to mental health resources may improve resident wellness and wellbeing and increase productivity.

While these findings can be applied broadly to other training programs and other disasters and prolonged mass casualty events, including those outside the United States and outside of emergency medicine, more quantitative and qualitative research in other sites as well as in the context of other pandemics is needed to establish these findings as universally applicable.

Since the start of the COVID-19 pandemic, there have been fluctuations in cases and new variants of COVID-19. It is anticipated that the world will face more infectious disease pandemics in the future. Most of the global population remains unvaccinated against COVID-19. Therefore, it is important for key decision-makers in resident education, hospital administration, and all levels of public health management, to inform themselves about residents' emotional and workplace challenges when establishing hospital and residency program disaster protocols. We suggest that the frontline resident experience should be prioritized accordingly in any healthcare system's response to unexpected pandemics and disasters, as providing emotional and material support to residents is likely to help residents be more effective in the workplace. More research is necessary to determine whether these interventions can prevent the long-lasting negative psychological effects of facing a prolonged trauma in and out of the workplace.

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Factors Associated with Neuroimaging Abnormalities in Children with Afebrile Seizure: A Retrospective Multicenter Study

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Introduction: Neuroimaging is recommended for patients with seizures to identify intracranial pathology. However, emergency physicians should consider the risks and benefits of neuroimaging in pediatric patients because of their need for sedation and greater sensitivity to radiation than adults. The purpose of this study was to identify associated factors of neuroimaging abnormalities in pediatric patients experiencing their first afebrile seizure.

Methods: This was a retrospective, multicenter study that included children who presented to the emergency departments (ED) of three hospitals due to afebrile seizures between January 2018–December 2020. We excluded children with a history of seizure or acute trauma and those with incomplete medical records. A single protocol was followed in the three EDs for all pediatric patients experiencing their first afebrile seizure. We performed multivariable logistic regression analysis to identify factors associated with neuroimaging abnormalities.

Results: In total, 323 pediatric patients fulfilled the study criteria, and neuroimaging abnormalities were observed in 95 patients (29.4%). Multivariable logistic regression analysis showed that Todd's paralysis (odds ratio [OR] 3.72, 95% confidence interval [CI] 1.03-13.36; P=0.04), absence of poor oral intake (POI) (OR 0.21, 95% CI 0.05-0.98; P=0.05), lactic acidosis (OR 1.16, 95% CI 1.04-1.30; P=0.01), and higher level of bilirubin (OR 3.33, 95% CI 1.11-9.95; P=0.03) were significantly associated with neuroimaging abnormalities. Based on these results, we constructed a nomogram to predict the probability of brain imaging abnormalities.

Conclusion: Todd's paralysis, absence of POI, and higher levels of lactic acid and bilirubin were associated factors of neuroimaging abnormalities in pediatric patients with afebrile seizure.
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INTRODUCTION

Seizures are one of the most common neurological disorders in children, with a prevalence of approximately 1%.[1,2] Febrile seizure is the most common type of pediatric seizure.[3] In comparison, afebrile seizure is relatively uncommon, but it is clinically significant. Numerous studies have reported a higher risk of abnormal neuroimaging findings and recurrence of seizure.[4-6]

Previous studies have recommended electroencephalography (EEG) and/or neuroimaging after the first afebrile seizure.[7-12] However, pediatric seizure patients rarely undergo EEG in the emergency department (ED) due to differences in staffing and problems such as limited EEG lab availability at night.[13] In contrast, brain imaging tests, including computed tomography and magnetic resonance imaging (MRI), are relatively accessible in the ED. In a previous multicenter study, a majority of the seizure patients (81%) underwent neuroimaging studies in the ED, while EEG was performed in only 3% of the patients at the same time due to lack of testing availability.[14] Furthermore, emergent brain imaging allows clinicians to identify intracranial pathologies and the need for immediate intervention in children with afebrile seizures.[9-12]

Clinicians should carefully consider the risks and/or benefits of brain imaging in pediatric patients because they typically require sedation and are much more sensitive to ionizing radiation than adults.[15,16] Therefore, it is important to identify associated factors of neuroimaging abnormalities in pediatric patients with first afebrile seizure. Clinical guidelines for evaluating the first afebrile seizure in children, which were published by the American Academy of Neurology, Child Neurology Society, and American Epilepsy Society, suggest that emergent neuroimaging should be performed in all pediatric patients who present with Todd's paralysis or have not returned to baseline status within a few hours after the seizure.[17] However, previous studies on emergent neuroimaging in pediatric patients with afebrile seizure did not take lab results into consideration.

The purpose of this study was to identify associated factors of abnormalities on emergent neuroimaging tests after the first afebrile seizure episode in children based on historical findings, physical examination, and lab results.

Population Health Research Capsule

What do we already know about this issue?
Neuroimaging is recommended in children presenting with a first afebrile seizure in the emergency department. However, there are risks of sedation and radiation.

What was the research question?
What factors are associated with neuroimaging abnormalities in children with a first afebrile seizure?

What was the major finding of the study?
Abnormal neuroimaging findings were present in 29% of patients. Higher levels of lactate and bilirubin, Todd's paralysis, and the absence of poor oral intake were factors associated with neuroimaging abnormalities.

How does this improve population health?
Our model could help emergency physicians identify pediatric patients who require brain imaging based on laboratory results and clinical findings.

METHODS

Study Design and Setting

This retrospective, multicenter study recruited pediatric patients who presented to three university hospitals (in Seoul, Chungcheong, and Gyeonggi, Republic of Korea) with seizures between January 2018–December 2020. These EDs serve approximately 40,000, 50,000, and 60,000 patients per year, respectively. Children aged 1 month to 18 years, who were afebrile for at least 24 hours and presented with their first seizure, were enrolled. We excluded children with a known seizure disorder, acute trauma, or incomplete electronic health records (EHR). The study was approved by our hospital institutional review board (IRB file no. 2021-03-030).

Patient Identification and Data Collection

We reviewed the EHR of 2,009 patients evaluated at the three EDs for seizures between January 2018–December 2020. In our retrospective study, we estimated a sample size based on a previous study about calculating adequate sample size for developing a clinical prediction model.[18] Data was extracted by three experienced reviewers. In case of discrepancy, the data extracted by the most senior reviewer was recorded. The following data was extracted from the medical records: age; gender; symptoms (ie, headache, vomiting, and poor oral intake [POI]); past history (related to birth, neonatal intensive care unit [NICU] admission, and family); number of seizures in the first 24 hours after presentation; duration of seizure; presence of Todd's paralysis; postictal features; seizure type; physical exam findings (ie, neck stiffness and Babinski sign); laboratory results (ie, blood pH, complete blood cell count, and bicarbonate, lactic acid, blood urea nitrogen, creatinine, glucose, albumin, bilirubin, aspartate aminotransferase, alanine transaminase, and C-reactive protein [CRP] levels). POI was defined as a lack of interest in feeding or a problem receiving the proper amount of nutrition and Todd's paralysis was defined as a neurological condition, in which a seizure is followed by a brief period of temporary paralysis. Also, lactate level above 2.0 mg/dL and bilirubin level above 1.2

mg/dL were considered abnormal in our laboratory results. Data collection was conducted in accordance with the recommendations of Worster et. al to reduce bias and comply with standards for EHR review.[19]

Neuroimaging Studies

Because the three study EDs share the same medical center, a single protocol was followed for all pediatric patients experiencing their first afebrile seizure. Therefore, most of the patients underwent brain imaging tests. We excluded patients for whom brain imaging was performed 24 hours post seizure, characterizing them as having incomplete EHR. A single neuroradiologist reviewed the neuroimaging studies. The neuroimaging findings were classified as cyst (ie, neuroglial or arachnoid cyst), infarction, hemorrhage, mass, encephalitis, dysplasia (ie, developmental venous anomaly or lissencephaly), focal (ie, focal heterotopia or focal encephalomalacia), cortical edema, periventricular leukomalacia [PVL], and non-specific lesions (ie, non-specific, increased T2 signal intensity in periventricular white matter).[10] In brain imaging studies, 157 patients (48.6%) underwent brain CT, 268 patients (83.0%) underwent MRI, and 102 patients (31.6%) underwent both CT and MRI.

Statistical Analysis

We present data as absolute numbers or relative frequencies for categorical variables, and as medians with interquartile ranges for continuous variables. *P*-values < 0.05 were considered to indicate statistical significance. We used Fisher's exact test or the chi-squared test to analyze categorical variables and the Mann-Whitney U test to analyze continuous variables. The Shapiro-Wilk test showed that all continuous variables did not follow a normal distribution. Multivariable logistic regression analysis was performed on factors that were statistically significant in the univariable logistic regression analysis and variables reported to be significantly associated in previous studies.[11,12,17] We calculated odds ratios (OR) with 95% confidence intervals (CI) to quantify the associations between the various factors and neuroimaging abnormalities. A nomogram based on the multivariable logistic analysis was constructed to predict brain imaging abnormalities. We performed statistical analyses using SPSS version 26.0 (IBM Corp., Armonk, NY) and R version 4.1.3 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

A total of 411,689 patients visited the three EDs during the study period, including 2,009 pediatric patients who visited the EDs due to a seizure. We excluded patients with fever (1,398), history of seizure disorder (186), history of acute trauma (59), and incomplete EHR including absence of neuroimaging tests (43). Finally, 323 patients were enrolled in

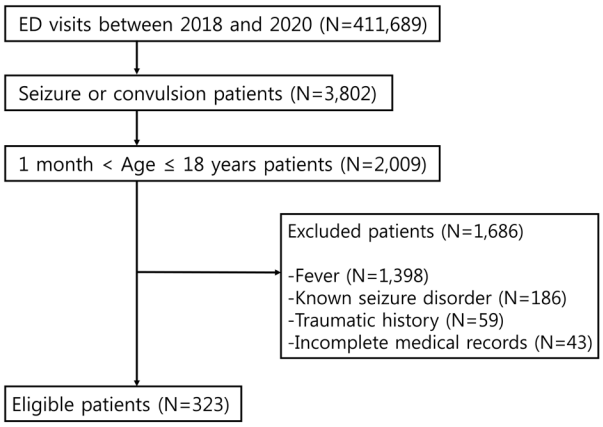

Figure 1. Flow chart of patient selection for study of neuroimaging in first afebrile pediatric seizure.
ED, emergency department.

Table 1. Baseline characteristics of pediatric patients with afebrile seizures.

	Total (N = 323)
Age at onset, years	7 [2.5–11.5]
Gender, n (%)	
Female	141 (43.65)
Male	182 (56.35)
Past history	
IUP, weeks	38 [37–39.3]
Birth weight, kilograms	3 [2.7–3.3]
C-sec, n (%)	147 (45.51)
NICU admission, n (%)	26 (8.05)
Familial history, n (%)	48 (14.86)
Symptoms, n (%)	
Headache	33 (10.22)
Vomiting	69 (21.36)
POI	24 (7.43)
Seizure features	
Seizure count, n	1 [1–1]
Duration, minutes	3 [2–5]
Todd's paralysis, n (%)	12 (3.72)
Postictal state, n (%)	231 (71.52)
Type, n (%)	
GTC	277 (85.76)
Focal	43 (13.31)
Secondary GTC	3 (0.93)

Categorical variables are presented as numbers (percentage). Continuous variables are presented as medians [interquartile range].
IUP, intrauterine pregnancy; *C-sec,* caesarean section; *NICU,* neonatal intensive care unit; *POI,* poor oral intake; *GTC,* generalized tonic-clonic.

the study (Figure 1).

General Characteristics

Table 1 shows the baseline characteristics of the patients. The median age was 7 (2.5–11.5) years. In total, 26 patients (8.05%) were admitted to the NICU, and 48 (14.86%) had a familial history of seizures. Headache and POI were present in 33 (10.22%) and 24 (7.43%) patients, respectively. The median number of seizures was 1 (1–1) and the median seizure duration was 3 (2–5) minutes. Twelve patients (3.72%) developed Todd's paralysis, and 231 (71.52%) developed a postictal state. Most seizures were of the generalized tonic-clonic (GTC) type (277, 85.76%), followed by focal type (43, 13.31%) and secondary GTC type (3, 0.93%).

Comparison of the Two Groups with Normal and Abnormal Neuroimaging

The differences between the normal and abnormal neuroimaging groups are summarized in Table 2. Abnormal neuroimaging findings were present in 95 patients (29.41%). No significant differences were observed in age, gender, medical history, number of seizures, or seizure type between the two groups. On physical examination, the number of patients with neck stiffness was greater in the abnormal neuroimaging group but showed no significant difference (3.16% and 0.44%, respectively; $P = 0.08$), and Babinski sign was identified in only one case, making it difficult to have a significant difference (1.05% and 0%, respectively; $P = 0.29$).

Fewer patients in the abnormal neuroimaging group had POI compared to the normal neuroimaging group (2.11% and 9.65%, respectively; P=0.02). In addition, Todd's paralysis was observed more frequently in the abnormal than normal neuroimaging group (7.37% and 2.19%, respectively; P=0.05). Compared to the normal neuroimaging group, patients in the abnormal neuroimaging group had higher levels of lactic acid (2 and 2.2 milligrams per deciliter [mg/dL], respectively; P=0.02) and bilirubin (0.34 and 0.4 mg/dL, respectively; P=0.03), and lower levels of albumin (4.6 and 4.5 grams/dL, respectively; P=0.02) and CRP (1.3 and 0.7 mg/L, respectively; P=0.03).

Main Outcomes

The results of the univariable and multivariable logistic regression analyses are shown in Table 3. Neck stiffness did not show a significant difference in univariable logistic regression analysis (OR 7.402, 95% CI 0.760-72.087; P=0.09). Todd's paralysis was significantly associated with abnormal neuroimaging findings (OR 3.718, 95% CI 1.034-13.364; P=0.04). Furthermore, POI was inversely associated with neuroimaging abnormalities (OR 0.213; 95% CI 0.046-0.976; P=0.05). The lactic acid (OR 1.161, 95% CI 1.035–1.302; P=0.01) and bilirubin (OR 3.330, 95% CI 1.114-9.952; P=0.03) levels were significantly associated with abnormal neuroimaging findings.

We used these factors to construct a nomogram (Figure 2) for predicting the probability of abnormal neuroimaging findings. The nomogram showed that lactate was the strongest associated factor of neuroimaging abnormalities, followed by bilirubin, absence of POI, and Todd's paralysis. Each associated factor was rated on a point scale (0–100). The probability of neuroimaging abnormalities was predicted by summing the scores of all factors. For example, a patient with Todd's paralysis and a bilirubin level of 1.0 mg/dL would have 45 and 40 points for each factor. After summing the scores, there were 85 total points, and the probability of neuroimaging abnormalities was 0.4 for the patient.

Neuroimaging Studies

In total, 95 patients had abnormal neuroimaging findings, which are summarized in Figure 3. The most common finding was cyst (30, 31.58%), followed by non-specific findings (19, 17.89%), infarction (10, 10.53%), dysplasia (9, 9.47%), and focal lesion (8, 8.42%). Hemorrhage (5, 5.26%), mass (5, 5.26%), PVL (5, 5.26%), encephalitis (3, 3.16%), and cortical edema (3, 3.16%) were also frequently identified.

DISCUSSION

In this multicenter retrospective study, we investigated associated factors of emergent neuroimaging abnormality in children with first-onset, non-febrile seizure from historical findings, physical exam, and lab results. Todd's paralysis, absence of POI, and higher levels of lactate and bilirubin were significantly associated with the abnormalities of brain imaging tests. In a previous prospective observational study, Paramasivam et al reported that 22 of 65 patients (33.85%) experiencing new-onset afebrile seizures had abnormal neuroimaging findings.[20] In addition, Al-Shami et al reported that 32 of 96 pediatric patients (33.33%) with afebrile seizures had neuroimaging abnormalities that were considered to be clinically significant by an experienced neuroradiologist.[12] Similarly, we found that 95 pediatric patients (29.41%) with afebrile seizures had abnormal neuroimaging findings.

Current practice guidelines for the evaluation of children experiencing their first afebrile seizure suggest that manifestations of focal seizures, such as Todd's paralysis and persistent mental status change, are risk factors for neuroimaging abnormalities.[17] Aprahamian et al reported that Todd's paralysis and age <18 months were associated factors of neuroimaging abnormalities requiring urgent care.[11] Amagasa et al also reported that neurological disorder, including impaired awareness, Todd's paralysis, and ataxia in physical examinations, was a risk factor for brain imaging abnormalities in children with first afebrile seizure.[21] In our study, we investigated both Todd's paralysis and physical findings such as neck stiffness and Babinski sign. We found that Todd's paralysis was a significant associated factor of neuroimaging abnormalities, while age, neck stiffness, and Babinski sign were not. Whether age is related to neuroimaging abnormalities varies from study to study.[11,20]

Table 2. Comparison of baseline characteristics between the two groups.

	Normal (n = 228)	Abnormal (n = 95)	P-value
Age at onset, years	6 [2–11]	7 [4–12]	0.39
Gender, n (%)			0.62*
Female	102 (44.74)	39 (41.05)	
Male	126 (55.26)	56 (58.95)	
Past history			
IUP, weeks	38 [37–39]	38 [37–40]	0.43
Birth weight, kilograms	3 [2.9–3.3]	3 [2.7–3.3]	0.70
C-sec, n (%)	100 (43.86)	47 (49.47)	0.39*
NICU admission, n (%)	15 (6.58)	11 (11.58)	0.18*
Familial history, n (%)	33 (14.47)	15 (15.79)	0.74*
Symptoms, n (%)			
Headache	21 (9.21)	12 (12.63)	0.42*
Vomiting	48 (21.05)	21 (22.11)	0.88*
POI	22 (9.65)	2 (2.11)	0.02*
Seizure features			
Seizure count, n	1 [1–1]	1 [1–1]	0.38
Duration, minutes	3 [1–5]	4 [2–7.5]	0.06
Todd's paralysis, n (%)	5 (2.19)	7 (7.37)	0.05**
Postictal confusion, n (%)	156 (68.42)	75 (78.95)	0.06*
Type, n (%)			0.62**
GTC	198 (86.84)	79 (83.16)	
Focal	28 (12.28)	15 (15.79)	
Secondary GTC	2 (0.88)	1 (1.05)	
Physical examinations, n (%)			
Neck stiffness	1 (0.44)	3 (3.16)	0.08**
Babinski sign	0 (0)	1 (1.05)	0.29**
Laboratory results			
pH	7.35 [7.31–7.39]	7.34 [7.29–7.38]	0.36
Bicarbonate, mmol/L	23.8 [22.1–26.0]	23.5 [21.2–25.5]	0.83
Lactate, mg/dL	2 [1.4–3.0]	2.2 [1.6–3.8]	0.02
WBC, 10^3/μL	8.59 [6.8–11.3]	8.79 [6.7–11.9]	0.69
Hb, g/dL	12.9 [12.1–13.6]	12.7 [12.1–13.7]	0.71
PLT, 10^3/μL	294 [249.8–346.3]	294 [256.5–353.5]	0.89
BUN, mg/dL	11.7 [9.0–13.6]	11.2 [9.1–13.1]	0.28
Cr, mg/dL	0.5 [0.39–0.66]	0.5 [0.4–0.7]	0.11
Glucose, mg/dL	102 [92–115]	104 [94.5–127]	0.14
Albumin, g/dL	4.6 [4.4–4.8]	4.5 [4.2–4.7]	0.02
Bilirubin, mg/dL	0.34 [0.22–0.48]	0.4 [0.3–0.53]	0.03
AST, U/L	29 [22–38]	28 [22–35]	0.34
ALT, U/L	14 [11.0–20.3]	14 [12–19]	0.73
CRP, mg/L	1.3 [0.3–4.6]	0.7 [0.3–2.1]	0.03

Categorical variables are presented as numbers (percentage) and were analyzed using the *Pearson chi-squared test or **Fisher's exact test. Continuous variables are presented as median [interquartile range] and were analyzed by Mann–Whitney U test. (All continuous variables did not have a normal distribution.)

IUP, intrauterine pregnancy; *C-sec,* caesarean section; *NICU,* neonatal intensive care unit; *POI,* poor oral intake; *GTC,* generalized tonic-clonic; *pH,* potential of hydrogen; *WBC,* white blood cell; *Hb,* hemoglobin; *PLT,* platelet; *BUN,* blood urea nitrogen; *Cr,* creatinine; *AST,* aspartate aminotransferase; *ALT,* alanine transaminase; *CRP,* C-reactive protein.

Table 3. Univariable and multivariable logistic regression analyses of risk factors for neuroimaging abnormalities in pediatric afebrile seizure patients.

	Univariable		Multivariable	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Seizure features				
Duration	1.017(0.994–1.040)	0.16		
Postictal confusion	1.731(0.982–3.051)	0.06		
Todd's paralysis	3.548(1.097–11.475)	0.03	3.718(1.034–13.364)	0.04
Symptoms				
POI			0.213(0.046–0.976)	0.05
Physical examinations				
Neck stiffness	7.402(0.760–72.087)	0.09		
Laboratory results				
CRP	0.899(0.767–1.052)	0.18		
Albumin	0.388(0.178–0.845)	0.02	0.531(0.218–1.289)	0.16
Bilirubin	3.078(1.167–8.122)	0.02	3.330(1.114–9.952)	0.03
Lactate	1.163(1.047–1.292)	0.01	1.161(1.035–1.302)	0.01

OR, odds ratio; *CI,* confidence interval; *POI,* poor oral intake; *CRP,* C-reactive protein.

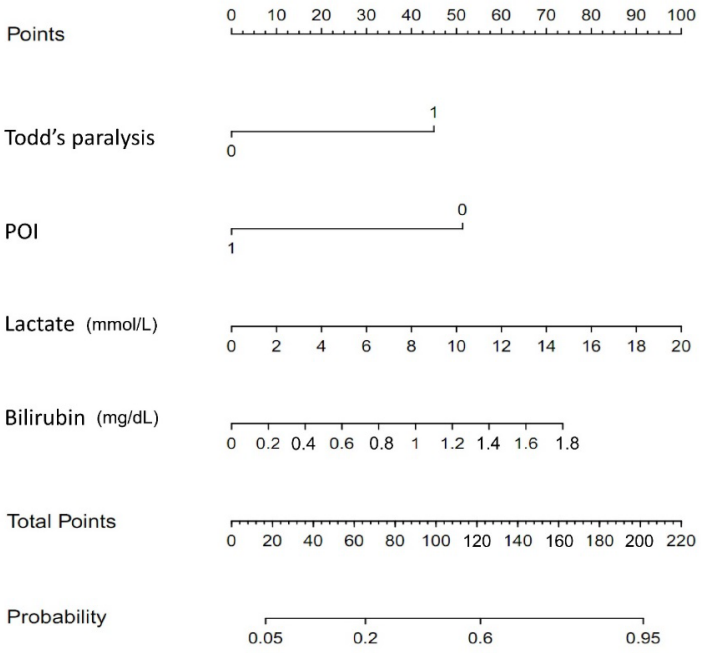

Figure 2. Nomogram for predicting neuroimaging abnormalities in pediatric patients experiencing their first afebrile seizure. Each factor was rated on the top visible point scale (0–100), and the probability of neuroimaging abnormalities was predicted by summing the scores of all factors. For example, a patient with Todd's paralysis and a bilirubin level of 1.0 mg/dL would have 45 and 40 points for each factor. After summing the scores, total points are 85, and the probability of neuroimaging abnormalities would be 0.4 for the patient.
POI, poor oral intake.

Similar to our study, Paramasivam et al reported no significant association between age and gender with neuroimaging abnormalities.[20] In our study, neck stiffness and Babinski sign showed higher numbers in the abnormal neuroimaging group. However, the number of patients with neck stiffness or Babinski sign was too small to determine the association. Further research on more detailed neurological examinations in pediatric afebrile seizure patients is needed.

In pediatric patients, POI may indicate several metabolic abnormalities such as hypoglycemia, hyponatremia, and hypocalcemia that can cause convulsions.[22,23] According to a previous study, 95.2% of infants and young children with gastroenteritis complained of POI and presented with ketosis or hypoglycemia, as well as hyponatremic dehydration.[24] In addition, pediatric patients with certain metabolic disorders, such as glucose transporter type 1 deficiency syndrome, may experience seizures; however, the syndrome is rare with an estimated birth incidence of 1 in 24,300 according to a previous study. For these patients, a ketogenic diet may prevent seizures.[24-26] In our study, absence of POI was an associated factor of neuroimaging abnormalities, where absence of POI may indicate intracranial pathology rather than metabolic problems in children.

With regard to lab results, previous studies reported that the lactic acid level is an excellent biomarker for discriminating seizures from psychogenic episodes and syncope, although the underlying mechanism is unclear.[27,28] Gunawan et al recently reported a correlation between serum lactate level and abnormal brain MRI findings in children with status epilepticus.[29] Lactate elevation and adenosine triphosphate depletion during the early phase of seizures are related to hypermetabolic neuronal damage.[29] Similarly, lactic acid was a strong associated factor of neuroimaging abnormalities in our pediatric patients experiencing their

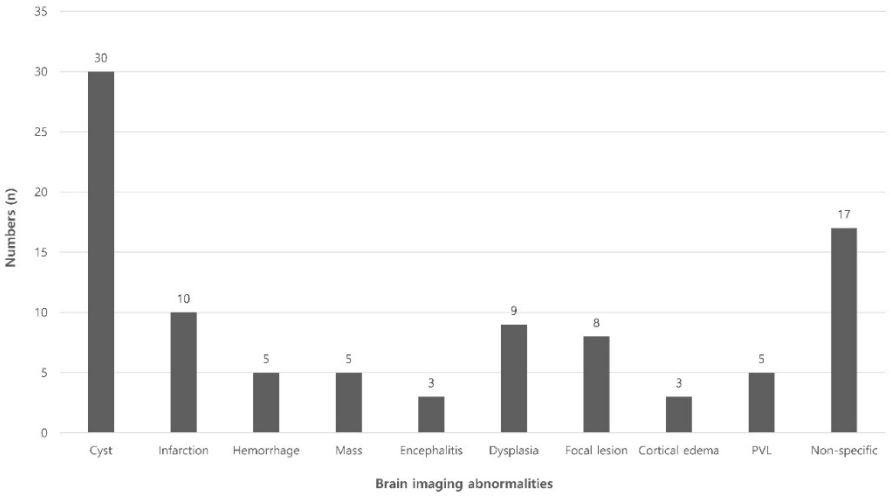

Figure 3. Classification of neuroimaging abnormalities.
PVL, periventricular leukomalacia.

first afebrile seizure. In addition, Shapiro et al reported that unbound and free unconjugated bilirubin can selectively damage the central nervous system in the developing brain.[30] However, bilirubin toxicity to the brain is only applicable to early neonatal age. In our study, a higher level of bilirubin was found to be significantly associated with neuroimaging abnormalities in pediatric patients with first afebrile seizure. Further research on how bilirubin affects the brain in pediatric afebrile seizure patients is needed.

The main strength of our study is that it presents a nomogram based on lab results and clinical findings, such as Todd's paralysis and POI, to predict neuroimaging abnormalities in children experiencing their first afebrile seizure. Because this data can be easily acquired in the ED, our predictive model could help identify pediatric patients who require brain imaging. To the best of our knowledge, this is the first study to identify associated factors of neuroimaging abnormalities in patients experiencing afebrile seizure based on symptoms and lab findings.

LIMITATIONS

Our study had several limitations. First, selection bias may have occurred due to the retrospective study design. However, the three study EDs shared the same protocol for pediatric afebrile seizure, which would minimize selection bias. While our goal was to investigate all known factors with regard to neuroimaging abnormalities in pediatric afebrile seizure patients, some may have been missed due to the limitations of a retrospective study design.[17, 20] Second, our neuroimaging findings are unclear as to whether the findings were the cause or the consequence of seizures. Third, caution should be exercised when generalizing the results because of regional differences. However, the study hospitals are located in major population centers in the Republic of Korea (Seoul, Bucheon, and Cheonan), which should improve the generalizability. Finally, while we estimated a sample size considering a previous study, the sample size might be too small to be generalized.[18] To overcome these limitations, large-scale prospective studies on neuroimaging abnormalities in pediatric patients with afebrile seizures are needed.

CONCLUSION

We found that Todd's paralysis, absence of POI, and higher levels of lactic acid and bilirubin were significant associated factors of neuroimaging abnormalities in pediatric patients with first afebrile seizure. We then constructed a nomogram to aid emergency physicians in making decisions quickly about initiating emergent neuroimaging tests for children with first afebrile seizure, as pediatric seizure patients with these findings should be closely monitored.

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Video Education Intervention in the Emergency Department

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Introduction: After discharge from the emergency department (ED), pain management challenges parents, who have been shown to undertreat their children's pain. Our goal was to evaluate the effectiveness of a five-minute instructional video for parents on pain treatment in the home setting to address common misconceptions about home pediatric pain management.

Methods: We conducted a randomized, single-blinded clinical trial of parents of children ages 1-18 years who presented with a painful condition, were evaluated, and were discharged home from a large, tertiary care pediatric ED. Parents were randomized to a pain management intervention video or an injury prevention control video. The primary outcome was the proportion of parents that gave their child pain medication at home after discharge. These data were recorded in a home pain diary and analyzed using the chi square test to determine significant difference. Parents' knowledge about components of at-home pain treatment were tested before, immediately following, and two days after intervention. We used McNemar's test statistic to compare incorrect pretest/correct post-test answers between intervention and control groups.

Results: A total of 100 parents were enrolled: 59 parents watched the pain education video, and 41 the control video. Overall, 75% of parents completed follow-up, providing information about home medication use. Significantly more parents provided pain medication to their children after watching the educational video: 96% vs 80% (difference 16%; 95% CI 7.8-31.3%). Significantly more parents had correct pain treatment knowledge immediately following the educational video about pain scores (P = 0.04); the positive effects of analgesics (P <0.01); and pain medication misconceptions (P = 0.02). Most differences in knowledge remained two days after the video intervention.

Conclusion: The five-minute educational video about home pain treatment viewed by parents in the ED prior to discharge significantly increased the proportion of children receiving pain medication at home as well as parents' knowledge about at-home pain management. [West J Emerg Med. 2023;24(2)287–294.]

INTRODUCTION

Approximately 57% of children have pain on arrival to the emergency department (ED).[1] Most children are discharged home with moderate or severe pain and require pain treatment.[2-5] Injuries (eg, fractures, sprains, strains, contusions) are the most common cause of ED visits by children in pain. Fractures account for 10-25% of the injuries in children, and fracture pain is most severe 48 hours after discharge from the ED, making early at-home pain treatment particularly important.[6,7] In a cross-sectional study, nearly 32% of parents reported dissatisfaction with the at-home pain management of their children with fracture pain when asked to recall their experiences during the prior week.[7] The impact of parental pain management knowledge on at-home pain experience and satisfaction is not known.[8,9]

Parents' knowledge of pain treatment is a priority since prior studies have shown parents lack pain management

knowledge and underestimate and undertreat their children's pain.[10-13] Some parents report the belief that pain prevents further injuries and that minimizing medication use is optimal, analgesics are addictive, and analgesics work better the less they are used.[13,14] Improving parents' knowledge by providing structured guidance may optimize children's home pain experience and is, therefore, essential to emergency medical care to promote the best patient outcomes.

Studies suggest that video instruction may be preferred by parents.[15,16] Video guidance circumvents some ED challenges such as limited time, insufficient personnel, and literacy level of caregivers.[17] Brief video education standardizes knowledge and avoids inconsistencies in information given by individual clinicians; using visual and auditory learning tools improves caregivers' knowledge and enhances self-efficacy at hospital discharge.[18-20] Cell phones, tablets, and computers are ubiquitous in the ED setting; so accessing an educational video can be quite simple. Structured information given both verbally and written with visual clues has improved recall and at-home compliance after discharge.[20] However, there are no studies of the use of a video to enhance caregivers' understanding of treatment of injuries after discharge.

Since many children with painful complaints are discharged home from the ED and are cared for by their parents, and parents are known to underestimate and undertreat pain, efforts should be made to reduce the pain experience at home. This is important because unrelieved severe pain can lead to an altered pain response, slower healing, anxiety, fear of medical encounters, decreased quality of life, and chronic pain.[21-23] Increasing parents' knowledge about pain management for their children may result in increased use of over-the-counter analgesics at home, which may translate into an improved pain experience for children. In this study we investigated whether an instructional pain treatment video shown to parents at ED discharge would increase their use of pain medication for their child at home and increase their knowledge about pain. We hypothesized more children would receive pain medication during the three days after discharge from the ED if their parents viewed the educational video in the ED. We also hypothesized that parental knowledge about pediatric pain management would improve after viewing an educational video in the ED.

Population Health Research Capsule

What do we already know about this issue?
Most children with pain in the emergency department (ED) have ongoing pain that needs treatment after discharge. Studies show parents underestimate and undertreat children's pain.

What was the research question?
Will an instructional video increase the proportion of children receiving pain medicine at home and improve parent knowledge?

What was the major finding of the study?
More parents provided medicine: 96% vs 80% and increased their knowledge for two days after the video presentation.

How does this improve population health?
An instructional video about pain management during the ED visit can change parents' behavior and increase their knowledge about their child's healthcare needs at home.

METHODS

Study Design and Setting

This was a single-blind randomized clinical trial evaluating an instructional video intervention to improve parents' pain knowledge and medication use in the home. This study was conducted between June–August 2011 in a children's hospital Level I trauma center ED with an average annual census of 65,000 patients, with an average of ~180 pediatric visits each day. The study was reviewed and approved by the institutional review board. All parents and children provided informed consent/assent before enrollment. This clinical trial was registered with the National Institutes of Health (clinicaltrials.gov identifier NCT00520442).

Population

A convenience sample of eligible parents of children ages 1-18 years presenting to the ED for painful chief complaints (including complaints of pain, injury, laceration, fracture, sprain, contusion, crush injuries, head injury, motor vehicle collision, burn, or non-traumatic painful injury), were approached for enrollment between 11 AM and midnight, seven days a week. Parents were not eligible if they were not the legal guardian, or the child did not report pain at time of enrollment or had a chronic painful condition (eg, sickle cell disease, rheumatoid arthritis). Parents were ineligible if they were not English-speaking or were inaccessible by telephone for follow-up.

Study Protocol

The figure summarizes the study protocol. After eligibility criteria were confirmed and consent was obtained, parents provided demographic information and completed a pain knowledge test to establish their baseline knowledge about pain treatment. Parents were randomized to the intervention educational video or control video but blinded to the study hypothesis. After evaluation and treatment in the ED, but prior to discharge, parents viewed the assigned video. Immediately after watching the video, they completed the same pain

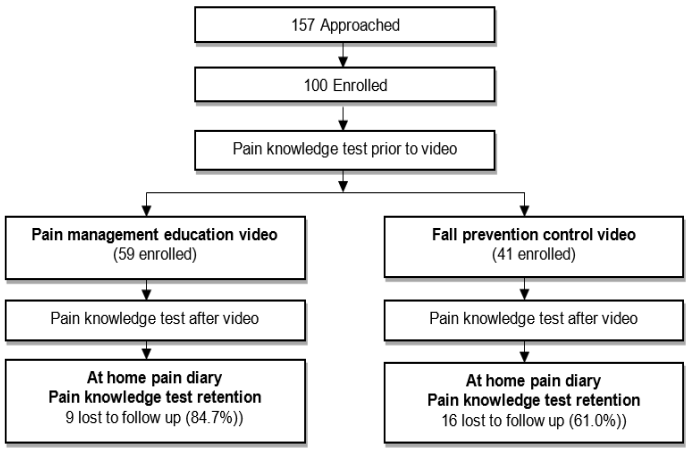

Figure. Summary of the study protocol.

knowledge test to evaluate immediate change in knowledge. All parents were then instructed on the use of an at-home pain diary to record their child's reported pain and pain medication use. On the second day after discharge, parents completed the same pain knowledge test to evaluate knowledge retention. The data from the at-home pain diary and answers to the knowledge test were all collected via daily standard follow-up telephone calls made during the first 48 hours after the ED visit. This timeline was chosen since the worst pain is typically experienced within 48 hours after ED discharge.[7]

All diagnosis and treatment decisions in the ED were made by board-certified pediatric emergency medicine specialists or fellows. Children received the usual care for their painful conditions in the ED. The treating physician and nurse provided the usual discharge instructions based on the discharge diagnosis to all families at time of discharge regardless of group assignment and were blinded to enrollment group. The ED did not have a standardized discharge recommendation for children with pain.

Randomization and Intervention

A random number table was used to assign parents to either an intervention or control video. The treating physician, nurse, patient, and parent were blinded to the video assignment and study hypothesis. The intervention video was a five-minute educational video designed to address outpatient pediatric pain and its management. The video was narrated by a pediatric emergency physician (AD) and was developed to incorporate known deficits in parent knowledge.[24] The control video was a five-minute video about pediatric fall and injury prevention.[25]

Methods of Measurement

Parent characteristics

Parent's age, race, gender, and level of education were collected using a parent report on a standard survey at time of enrollment.

Child characteristics

Child's age, pain score at arrival and discharge, and painful conditions were abstracted from the patient record. The child's pain in the ED was measured with the pain tool appropriate for age with a score range of 0-10.

Analgesic Use

The primary outcome of interest was parent's use of any analgesic for their child at home during the first 48 hours after discharge from the ED, including ibuprofen or acetaminophen or prescribed analgesics. This outcome was chosen as any increase would represent a change in the parent's home management of pain. Parents used an at-home pain diary, previously developed for prior follow-up studies in our ED, that detailed time and type of home analgesic medication to facilitate verbal report at the daily telephone follow-up call.[5]

Pain Knowledge Assessment

Parents completed a pain knowledge test, a seven-question true-or-false quiz that focused on common knowledge gaps in pediatric pain management including pain awareness, pain assessment, and pain medication effects (Table 1). Three questions queried knowledge about fall and injury prevention, which was the focus of the control video. Items in the pain knowledge test were derived from a prior qualitative study of pain investigating parents' knowledge, behaviors, and attitudes regarding at-home pain treatment.[23] Parents completed this test before viewing the video (N = 100), after viewing the video

Table 1. Pain knowledge test.

1.Brain injury is the #1 killer of children in the US today. (TRUE)*
2. Most children do NOT experience pain after they go home from the emergency department. (FALSE)
3. Pain scores can help measure pain for kids and pain scores of 4 or more should be treated. (TRUE)
4. Children who use pain medications will become addicted. (FALSE)
5. Most infant injuries occur when a parent leaves the child alone in a room. (FALSE) *
6. Pain medications can hide underlying problems. (FALSE)
7. Using pain medications after painful injuries can get children back to normal activities quicker. (TRUE)
8. Using pain medications can help children heal better. (TRUE)
9. Window screens are generally secure enough to hold a child inside a house. (FALSE) *
10. Using pain medication is the only way to effectively treat pain. (FALSE)

*Questions identified with an asterisk were included to test knowledge gained about falls prevention that was the focus of the control video that was viewed.
US, United States

but prior to discharge (N = 100), and 48 hours after discharge from the ED (N =75; 50 were in the intervention group). Test results were never discussed with the family.

Data Analysis

This was a superiority study, designed to detect a 35% relative improvement in the primary outcome: the parent's administration of pain medication to their child at home during the first 48 hours. An increase in the use of at-home pain medication by parents was defined as the parent's use of at least one dose of any pain medication. Based on prior research, use of any at-home pain medication by parents was estimated to be 60%, and a 35% improvement in this rate was felt to be clinically important.[26] Improvement by 35% would require 25 patients in each group to obtain an alpha = 0.05 and a beta = 0.20. A priori subgroup exploration was planned to investigate differential medication use when comparing younger to older children (cut-points of 6 years and 12 years), gender, race/ethnicity, and higher ED pain scores (score of 4 or greater).

We used descriptive statistics to analyze the demographic data. The intention-to-treat model was used to analyze outcomes. We compared increased pain medication use using chi-square test. The knowledge assessment results pre-video were combined for the intervention and control group. The knowledge assessment results for each of the three assessment periods were tabulated for the intervention and control group separately. We assessed the effect of the video intervention on parent knowledge using the McNemar test to compare incorrect pretest/correct post-test answers between intervention and control groups. The McNemar test was also used to examine the effect of the video on retained knowledge by comparing parents' pain knowledge before the video and 48 hours after discharge. Each question was analyzed independently. We explored the effect of the video intervention on the child's pain experience using the *t*-test to evaluate the median difference in pain scores, comparing the two groups.

RESULTS

Characteristics of the Subjects

During study enrollment, 157 eligible parents and their children were approached for participation in the study; 57 refused, leaving 100 parents and their children enrolled and randomized (Figure). We had excellent follow-up, with 75% of participants completing the 48-hour phone follow-up for knowledge retention and pain score reporting. For the intervention and control group, parents who were lost to follow-up were not different with respect to demographic characteristics (parent gender, age, race/ethnicity, education, or child's age, pain on arrival and discharge), baseline pain knowledge, or knowledge after viewing the video. Baseline characteristics for the two groups are shown in Table 2.

Mostly mothers were enrolled, and the distribution of race/ethnicity and level of education is comparable to what is seen in this ED. Pain intensity experienced by children in the intervention and control groups was similar on arrival and after discharge from the ED. Painful injury complaints of children enrolled in the study included the following: fractures; sprains; lacerations; burns; motor vehicle collisions; contusions; and non-traumatic painful injuries.

Table 2. Baseline characteristics for the two groups.

Characteristics	Intervention n (%) N = 59	Control n (%) N = 41
Parent Gender – female	50 (85%)	35 (85%)
Parent Age		
Mean (years)	36.2	36.2
Range (years)	20-62	20-62
Parent Race /Ethnicity		
White	31 (52%)	24 (58%)
Asian	0 (0%)	3 (7%)
Black	16 (27%)	6 (15%)
Hispanic	9 (15%)	5 (12%)
Other	3 (5%)	3 (7%)
Parent Education		
Some high school	7 (12%)	4 (10%)
High school graduate	12 (21%)	8 (20%)
Some college	11 (19%)	11 (27%)
College graduate	17 (29%)	11 (27)
Graduate studies	11 (19%)	7 (17%)
Child's Age		
Mean (years)	7.5	7.5
Range (years)	1-18	1-18
Child's Pain Experience: (median score)		
ED arrival	5	4
ED discharge	2	2

ED, emergency department.

Analgesic Use

The primary outcome was the proportion of parents that gave their child any medication in the first 48 hours after discharge from the ED. Significantly more parents provided pain medication if they viewed the intervention video (96%) compared to parents who viewed the control video (80%) (difference: 16%; 95% CI 7.8-31.3%). Planned subgroup analyses were performed to identify children less likely to receive any analgesic at home. No difference was found in the proportion of children given any medication when comparing younger to older children, gender, race/ethnicity, or arrival and discharge pain scores of 4 or greater (moderate/severe pain).

Parent Knowledge Assessment

See Table 3. Baseline knowledge was similar in the two groups. For both the intervention and control group together

Table 3. Parent knowledge assessment.

True/ false Statement	Pre-video		Post-video			2-day retention		
	Intervention	Control	Intervention	Control	p-value	Intervention	Control	p-value
Awareness								
1. Most children do NOT experience pain after they go home from the ED. (false)º	84.7%	85.4%	81.4%	75.6%	0.49	95.9%	79.1%	0.02*
Assessment								
2. Pain scores can help measure pain for kids and pain scores of 4 or more should be treated. (true)Φ	88.1%	82.9%	100.0%	83.0%	0.001*	100.0%	91.7%	0.04*
Pain								
3. Children that use pain medications will become addicted. (false)	96.6%	97.6%	98.3%	95.1%	0.36	93.9%	95.8%	0.73
4. Pain medications can hide underlying problems. (false)◊	37.9%	24.4%	61.0%	34.2%	0.02*	57.1%	37.5%	0.12
5. Using pain medications after painful injuries can get children back to normal activities quicker. (true)Φ	57.6%	63.4%	98.3%	68.3%	<0.00*	93.9%	66.7%	0.002*
6. Using pain medications can help children heal better. (true)Φ	64.4%	61.0%	96.6%	56.1%	<0.00*	93.9%	58.3%	<0.00*
7. Using pain medication is the only way to effectively treat pain. (false)	87.9%	85.4%	79.7%	82.9%	0.69	92.8%	87.5%	0.55

This table reports the proportion of parents with correct answers. McNemar's test and associated P-value were used to determine likelihood that a parent who changes from an incorrect answer to a correct answer on the pain knowledge test belongs to the intervention group.
Statements marked with an Φ were significantly more likely to be answered correctly in the intervention group during both assessments.
Statements with an ◊ were significantly more likely to be answered correctly in the intervention group only immediately after the video was viewed.
Statements marked with an ºwere significantly more likely to be answered correctly in the intervention group only 2 days after the video was viewed.
*denotes statistically significant changes in correct answers compared to Pre-video.

prior to viewing the video, many parents (85%) were aware that children do experience pain after they go home from the ED (question #1) and pain scores can measure pain for kids (86%) (question #2). Parents' knowledge about the effects of pain medication was more variable. Nearly all parents (97%) knew that children who use pain medication will not become addicted (question #3), and many (87%) knew that using pain medication is not the only way to effectively treat pain (question #7). However, a knowledge gap was noted for the positive effects of pain medications: only 60% of parents knew using pain medication can get children back to normal activities more quickly (question #5 and only 63% knew medications can help children heal better (question #6). Few parents (31%) understood that pain medication does not hide underlying problems (question #4).

The proportion of parents with correct answers to the knowledge questions immediately after the intervention video was viewed are shown for both groups in Table 3. Differences in the proportion of parents that initially provided the wrong answer and then had the correct answer after the video when comparing the two groups are shown as a *P*-value. Significant improvements were found in parents' knowledge about using a pain score for children (question #2), the positive effects of pain medication (questions #5 and #6), and the understanding that pain medications don't hide underlying problems (question #4). However, awareness for pain experience after the ED (question #1), knowledge that children would not become addicted to pain medication (question #3), and an understanding that there are alternative ways of treating pain (question #7) remained high but were not significantly different.

Parents' retention of the knowledge improvements two days after watching the video is also shown for both groups in Table 3. Differences in the number of parents that initially provided the wrong answer and then had the correct answer after the video when comparing the two groups are shown. The proportion of parents who knew that children experience pain after they go home from the ED significantly improved in the intervention group (question #1). Although this improvement was not apparent immediately after the video

was viewed in the ED, it was noted at 48-hour follow-up. The significant improvements in parents' knowledge about using pain scores (question #2) and the positive effects of the pain medications (questions #5 and #6) remained at 48 hours after ED discharge. The significant improvement in the understanding that pain medication will not hide underlying problems (question #4) that was apparent immediately after the video was viewed was no longer found.

DISCUSSION

At-home pain treatment by parents for children has been shown to be inadequate.[3-5,12,13,27-31] This study provides evidence to support the use of an instructional five-minute pain treatment video for parents in the ED setting to increase at-home pain treatment and parent knowledge. After viewing the video, a significantly higher proportion of parents administered pain medications for their children's pain, and significant improvements in parents' knowledge, particularly for the use of pain assessments and the positive aspects of using pain medications for children were shown. Current literature shows at-home pain treatment by parents for children is inadequate in many cases. This simple video presentation that can be implemented in the ED setting may help to improve care for children. This is a first step in the development of an ED intervention to optimize at-home pain treatment for children.

Videos,[10,15,18,32-34] online videos,[9,35] and web-based modules[9,35] improved parents' knowledge of pediatric disease management and the comprehension of discharge instructions by caregivers of children presenting to the ED for pediatric gastroenteritis[32,33] bronchiolitis,[33] and fever.[33,34] However, very few studies have been conducted using digital media as an intervention in pediatric fractures and painful injuries as a method to improve caregivers' knowledge.

Digital media, which included web-based modules,[9] videos,[9,10,18] and mobile discharge instructions videos,[36] improved the understanding of pain management and discharge instructions for fractures and painful injuries. Bloch and Bloch[18] enrolled parents of children (29 days–18 years) in the ED with a number of chief complaints to determine whether video discharge instructions as an adjunct to standard written questions would improve caregivers' comprehension of the children's ED visits, medical plans, and follow-up instructions. The video discharge instructions significantly improved caregivers' understanding in the ED and 2-5 days after discharge for children with non-painful complaints. Uniquely, our study enrolled children with painful chief complaints to evaluate the impact of the video not only to increase caregivers' understanding of how to treat painful injuries in the home setting, but perhaps, more importantly, to affect the pain medicine administered to their children in the at-home setting. Our study showed a significant improvement in caregivers' pain management knowledge, which is consistent with work reported by other investigators.[9,10,35]

Prior studies have shown that children with a fracture often do not receive treatment for pain.[37-40] For example, of children discharged home from the ED with a bone fracture, 30% received no more than one dose of pain medication each day after the injury, despite reported high pain scores.[11] In a clinical trial comparing analgesic effectiveness in the at-home setting, only 48% of children with moderate or severe fracture pain always received pain medication from their parents.[41] This study showed the video intervention impacted at-home care for children. No other studies have shown that an ED intervention changes at-home actions by parents. This is a first step in the development of an intervention that may optimize at-home pain treatment.

There is no widely accepted discharge instruction standard for children, which may hinder efforts to improve parents' knowledge after ED discharge.[42] Discharge instructions are an essential factor in the ED visit aftercare.[32] Some barriers to optimizing this process may be time constraints and variable discharge instructions[43,44] and poor-quality instructions.[45,46] Also, caregivers' comprehension, recall of treatment plan, and follow-up plan are known to be inadequate.[46,47] Literacy may also play a role in the lack of comprehension of the discharge instructions.[17] Incomplete understanding of the discharge instructions may lead to incorrect treatment after discharge, readmissions, and a higher rate of dissatisfaction with care.[32] Understanding of and compliance with discharge instructions has become more important as the management of more acute conditions is being shifted to the outpatient setting.[47] In this regard, the pain management video standardized the information parents received. The increase in parents' knowledge of pain management during painful injuries suggests that the video increased knowledge, which may be a key driver in optimizing at-home pain treatment.

Parents play a critical role in the treatment of a child's pain in the at-home setting. Their decisions and behaviors are key factors in the child's pain experience that are likely guided by their knowledge of pain management. It is not known why parents are not using pain medication as advised at home. It has been hypothesized that parents underestimate their child's susceptibility to and severity of pain in the at-home setting, but the causality has never been prospectively investigated.[11-13] The perceived risks and benefits of analgesics have also been hypothesized to affect parents' decisions, as demonstrated by a number of myths reported by parents, including the belief that an analgesic might mask symptoms or that medications should only be used as a last resort.[41,48,49] Adverse effects and addiction potential are also concerns to parents.

Given the complexity of the pain experience, several factors likely account for inadequate at-home pain treatment for children. A parent's decision to administer analgesics is the central behavioral determinant of the child's pain experience, and this decision is shaped by the parent's knowledge and experiences. This is one of the few

investigations of an ED educational video to impact this pivotal decision-making process. This distinctive, evidence-based intervention was successful in significantly improving parents' use of analgesics for pain for their children at home and has the potential to be a first step toward improving the at-home pain experience for children.

LIMITATIONS

Not all eligible patients were recruited due to the convenience sampling. This study was single blinded because a single researcher (NJ) provided the video and collected the outcomes. Another limitation is that our study could not discern whether the increase in the use of and knowledge about pain medication was due to the daily phone calls to collect outcomes (Hawthorne effect). Further, the study was conducted at a single teaching hospital, and non-English speakers and lack of phone for follow-up were excluded, possibly limiting its generalizability. Outcomes were collected within 48 hours after ED discharge when pain is generally most severe,[6,7] so it is not known whether this intervention impacted pain experienced after this timeframe. Finally, it is not known whether these increases in pain medication administered impacted the child's pain experience.

CONCLUSION

A five-minute instructional pain-treatment video shown to parents during the ED visit increased parents' use of pain medication for their child at home. Further, the instructional video increased parents' knowledge of pediatric pain management.

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Proceedings from the 2021 SAEM Consensus Conference: Research Priorities for Interventions to Address Social Risks and Needs Identified in Emergency Department Patients

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Introduction: Emergency departments (ED) function as a health and social safety net, regularly taking care of patients with high social risk and need. Few studies have examined ED-based interventions for social risk and need.

Methods: Focusing on ED-based interventions, we identified initial research gaps and priorities in the ED using a literature review, topic expert feedback, and consensus-building. Research gaps and priorities were further refined based on moderated, scripted discussions and survey feedback during the 2021 SAEM Consensus Conference. Using these methods, we derived six priorities based on three identified gaps in ED-based social risks and needs interventions: 1) assessment of ED-based interventions; 2) intervention implementation in the ED environment; and 3) intercommunication between patients, EDs, and medical and social systems.

Results: Using these methods, we derived six priorities based on three identified gaps in ED-based social risks and needs interventions: 1) assessment of ED-based interventions, 2) intervention implementation in the ED environment, and 3) intercommunication between patients, EDs, and medical and social systems. Assessing intervention effectiveness through patient-centered outcome and risk reduction measures should be high priorities in the future. Also noted was the need to study methods of integrating interventions into the ED environment and to increase collaboration between EDs and their larger health systems, community partners, social services, and local government.

Conclusion: The identified research gaps and priorities offer guidance for future work to establish effective interventions and build relationships with community health and social systems to address social risks and needs, thereby improving the health of our patients. [West J Emerg Med. 2023;24(2)295–301.]

BACKGROUND

Although the concept of social medicine has existed for nearly two centuries, the contemporary medical community has only more recently acknowledged the interconnectedness of socioeconomic status and health. Often credited as the founder of social medicine, physician Rudolf Virchow in 1848 helped establish the newspaper *Medical Reform* and brought attention to the social origins of illness.[1,2] More recently, multiple medical organizations, including the American College of Physicians,[3] the American Academy of Pediatrics,[4] and the American Academy of Family Physicians,[5] have advocated addressing social risks and needs in clinical settings to improve health outcomes.

Patients with unmet social risks and needs, such as food insecurity or unstable housing, have a higher prevalence of depression, diabetes, and hypertension, among other health issues.[6] Children with unmet social risks and needs have a higher prevalence of disease, such as asthma,[7,8] and have worse control of conditions such as type 1 diabetes.[9] These children are also more likely to experience obesity, diabetes, and cardiovascular disorders in adulthood.[10] Those with multiple social risks and needs experience a cumulative effect on their health.[11-13]

Emergency departments (ED) function as a health and social safety net,[14,15] regularly taking care of patients with high social risks and needs.[16] Nearly one in four ED patients is food insecure, and one in five reports choosing between food and medication.[17] Patients seen in the ED experience a high prevalence of financial insecurity,[18] unreliable transportation,[19] unemployment,[20,21] and housing instability.[21,22] Visits to the ED present unique opportunities to intercede and address the social risks and needs of patients. Most of the emergency medicine (EM) literature on social determinants of health focuses on identifying and screening for social risks and needs.[16] Few studies have examined ED interventions to address social risks and needs. In this article, we describe the research gaps and priorities for interventions addressing social risks and needs identified as part of the 2021 Society for Academic Emergency Medicine (SAEM) Consensus Conference – From Bedside to Policy: Advancing Social Emergency Medicine and Population Health through Research, Collaboration, and Education.

Population Health Research Capsule

What do we already know about this issue?
Emergency departments (ED) serve as a safety net by regularly taking care of patients with high social risks and unmet social needs.

What was the research question?
What are the research gaps and priorities in interventions for ED patients with social risks/needs?

What was the major finding of the study?
We identified three gaps and six research priorities in ED-based social risks and needs interventions.

How does this improve population health?
The derived gaps and priorities offer guidance for future research to establish effective ED-based interventions and build links between health and social systems.

METHODS

The leadership team of the 2021 SAEM Consensus Conference session on social risks and needs screening identified three topics for review: 1) instruments used for social risks and needs screening in the ED; 2) implementation of social risks and needs screening in the ED; and 3) interventions for patients with social risks and needs in the ED.[23] In this paper we address the third topic, presenting gaps in current knowledge and research priorities focused on interventions for patients with identified social risks and needs. For consistency across these three topics, we have adopted the definitions for social determinants of health as per Alderwick et al: social risk, defined as social conditions associated with poor health; and social need, defined as these social conditions with which patients would like assistance in addressing.[24]

Literature Review

We conducted a literature review building upon a previously published systematic review on ED patients' social risks and needs.[16] With the assistance of a health sciences librarian, we used a PubMed search strategy that identified 2,085 articles across the three objectives (Appendix A). A review of titles and abstracts resulted in 151 potentially relevant articles across the continuum from screening through interventions. We complemented the PubMed search with a review of the Social Interventions Research and Evaluation Network (SIREN) Evidence and Resource Library, which compiles research on medical and social care integration.[25] Based on titles and abstracts, authors HD and CF identified an additional 22 potentially relevant articles. Of the 173 total manuscripts identified, 18 applied to our topic—interventions for identified social risks and needs—after review of the full article.

We excluded articles if they had not been conducted in the ED or an urgent care within a hospital. Articles with interventions conducted across a hospital or health system, even if they did not focus primarily on ED patients, were included if the intervention was also incorporated into the ED. We then supplemented our article searches by checking the

references within these 18 publications for additional pertinent articles to our topic; we identified four additional articles. In total, 22 articles were included in our review (Figure 1).[26-47]

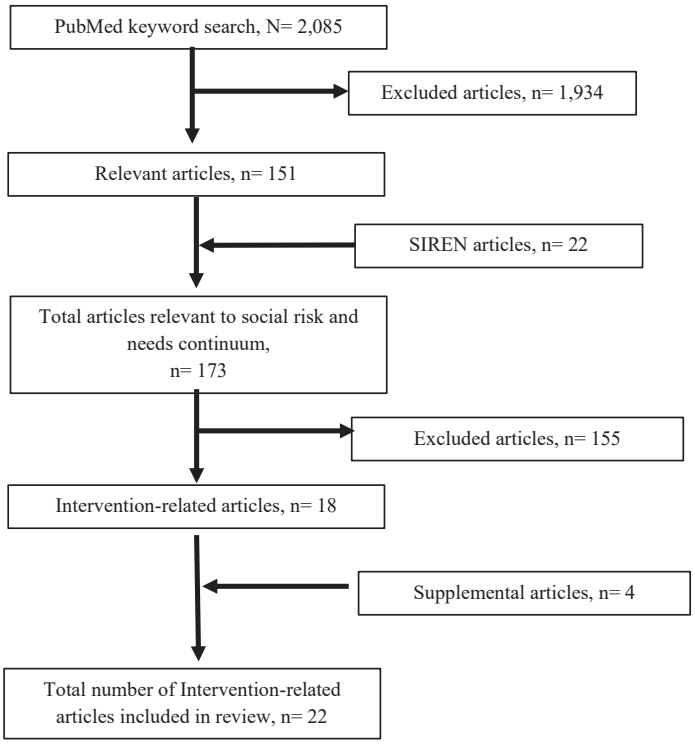

Figure 1. Flow diagram of literature review search results. *SIREN*, Social Interventions Research and Evaluation Network.

Initial Derivation of Research Gaps and Priorities

For each included study, we extracted data pertaining to study objective, design, outcomes, results, limitations, and noted study quality and risk of bias issues. This data was summarized in an analysis matrix (Microsoft Excel for Mac, version 16.52 (Microsoft Corporation, Redmond, WA). Our group thematically analyzed data from the analysis matrix; we then identified research gaps and drafted preliminary research priorities. We shared the draft research priorities with external expert reviewers from the Department of Health and Human Services Office of the Assistant Secretary for Planning and Evaluation,[48] Health Leads,[49] and SIREN,[50] incorporating their feedback into a document outlining preliminary research gaps and priorities (Appendix B).

Consensus-building and Derivation of Final Research Gaps and Priorities

The SAEM Consensus Conference was convened in two sessions virtually over Zoom (Zoom Video Communications, Inc, San Jose, CA) on April 13 and 27, 2021 (Figure 2). Preliminary research gaps and priorities (Appendix B) were presented to participants of the Consensus Conference during the moderated first session on April 13. Conference participants included academic EM faculty and residents,

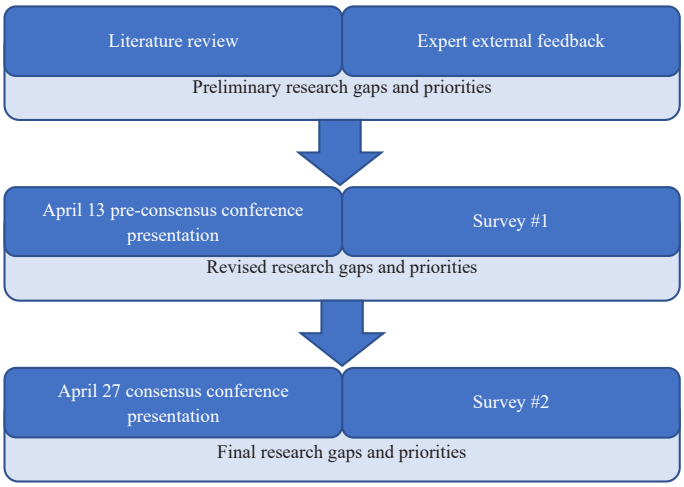

Figure 2. Consensus process to identify social risks and needs interventions.

community emergency physicians, and medical students. Then, scripted moderated discussions followed based on the previously identified gaps. Participants were allowed time to give verbal feedback. After the presentation session, registered conference participants provided feedback using an electronic survey (Table 1). A free-text option was included in the survey.

The survey questions were developed and distributed by the Consensus Conference leadership for each objective subgroup. Survey feedback was incorporated into a revised list of research priorities, and the revised list was presented in small groups during session two of the SAEM 21 Consensus Conference on April 27. Participants were then sent a second survey asking them to rank what they believed were the top three research priorities for social risks and needs interventions in the ED. Priorities were scored and then ranked, using the following formula:

Total score = 3x (# 1st choice votes) + 2x (# 2nd choice votes) + 1x (#3rd choice votes).

Priorities were ranked as high, medium, or low based on the top one-third, middle one-third, and lowest one-third of votes, respectively (Table 2).

FINDINGS and DISCUSSION

Overall, our workgroup identified 22 studies evaluating social risks and needs interventions among ED patients.[26-47] Initial group discussions identified an abundance of gaps and unanswered questions. We elected to group these gaps into generalized, broad categories rather than focus on granular issues that would not address the breadth of our objective.

Of the 22 studies, one was a systematic review,[42] five were randomized control trials (RCT) or secondary analyses of an RCT,[29,33-35,43] while the rest were observational studies. Study size ranged from 19 to 34,225 with most studies including several hundred participants. We identified two

Table 1. Survey questions regarding proposed initial research gaps and priorities.

Are there any research priorities that you feel are missing from this list? Yes/No. (Mandatory)
a. If yes, please list them and note why they should be added. (Optional)
Are there any research priorities that you feel should be removed? Yes/No. (Mandatory)
Which research priorities should be discussed further in the April 27 breakout sessions? Why? (Mandatory)
Please rank the top 3 research priorities based upon their priority for future research. Please consider the SMART criteria (Specific, Measurable, Attainable, Relevant, Time-based) when completing this exercise.

Table 2. Ranked research priorities related to interventions addressing social risks and needs among ED patients. Total score is weighted (3 points for priority 1 vote, 2 points for priority 2 vote, and 1 point for priority 3 vote).

Question	Priority 1	Priority 2	Priority 3	Total Points	Priority
Which patient-centered outcomes (e.g., resolution of social need, patient self-identified need or improvement, health metrics, and ED utilization) should be used to assess the impact of interventions?	10	2	7	41	High
Which interventions are most effective in reducing social risks and helping address patients' social needs? Which interventions are not effective and should be abandoned?	9	4	6	41	High
How can EDs integrate interventions into ED operations to increase feasibility and sustainability? Are existing staffing models sufficient to support the pragmatic implementation of interventions?	4	9	5	35	High
How can EDs reduce barriers (e.g., clinician/staff burnout, ED length of stay, and EHR/documentation burden) and increase acceptance of interventions?	7	3	2	29	Medium
Which interventions increase communication, coordination, and collaboration between EDs, their larger hospital or health systems, EMS, community partners, social services, and other systems? How can EDs provide warm handoffs to these systems?	1	7	5	22	Medium
How can interventions be tailored to increase patient linkage with resources and facilitate monitoring of outcomes? What forms of technology may be useful?	1	5	4	17	Medium
How can interventions effectively leverage the EHR (e.g., the inclusion of ICD-10 codes for social risks/needs in patient problem lists and EHR-facilitated interventions such as auto-referral lists)?	0	4	2	10	Low
Which interventions are favored by patients, clinicians, and hospitals/ healthcare systems?	2	0	3	9	Low
What is an adequate length of time to examine social need/risk intervention outcomes? How should we define "short-term" vs "long-term" outcomes?	0	0	0	0	Low

ED, emergency department; *EHR*, electronic health record; *EMS*, emergency medical services; *ICD-10*, International Classification of Diseases, 10th Revision.

studies performed at a non-academic community hospital; the remaining 20 studies were conducted at academic centers.[41,45] Eight studies explicitly mentioned including non-English speaking patients; of these studies, Spanish was the predominant non-English language.[30,33-35,39,43,44,46] Nine studies did not explicitly state whether they included non-English speakers.[26-28,32,36,40,41,45,47] Only one study included a rural site.[32]

Gap 1: Assessing Intervention Effectiveness

Our literature review revealed a variety of outcome measures used to evaluate intervention performance. Twelve studies relied on the number of referrals placed to community resources,[26-29,36-42,47] six reported community resource utilization,[26,29,35,39,44,47] six reported healthcare utilization,[27,39,43-46] and only one analyzed cost savings.[44] Four studies described patient satisfaction with the intervention,[26,28,39,41] and six presented self-reported health improvements as outcomes.[26,32,34,37,38,42] Our group discussions noted a lack of patient-centered outcomes in past studies. Expert comments, discussions during the Consensus Conference, and survey results agreed that identifying appropriate patient-centered outcomes, such as hunger-free days, improvement in housing, and symptom reduction should be a high research priority in the future.

We noted a literature gap in evaluating intervention cost and cost savings for patients and healthcare systems. One of our expert reviewers agreed that this should be an area of future exploration. Another expert reviewer noted

that cost savings would be challenging to measure (eg, secondary to cost-shifting), and research surrounding cost may prematurely divert attention from examining the efficacy of the interventions. As cost is generally not a patient-centered outcome and is borne by the healthcare system or insurers, and because our goal is to improve the health and quality of life for patients, our workgroup chose to prioritize questions related to intervention effectiveness, rather than cost.

The initial research priorities included a question regarding the hypothesized time horizon for evaluating the impact of interventions, given concern that time frames for seeing impact from interventions addressing social needs might be longer than examined in most traditional medical studies. This question was presented during the first session on April 13, ranked low in the first survey, and did not receive any votes in the final survey. We ultimately did not include this question separately in the final research priorities, but a consideration of timeframe is inherent in the questions evaluating intervention effectiveness.

We identified only four comparative effectiveness studies of social need interventions.[33-35,43] Three separate questions were initially presented during the Consensus Conference addressing the comparative effectiveness of interventions. All three ranked highly in the first survey. Based on discussions during the conference, we combined these into question 2 below, which also rated as high priority in the final survey. The following research priorities were developed to address the assessment of interventions:

1. Which patient-centered outcomes (eg, resolution of social need, patient self-identified need or improvement, health metrics) should be used to assess the impact of interventions?
2. Which interventions are more effective in reducing social risk and helping address patients' social needs? Which interventions are not effective and should be abandoned?

Gap 2: Integration of Interventions into the ED Environment

Our literature review revealed that while some studies have examined interventions in practice and comment on implementation, no study has sought to evaluate implementation rigorously. While implementation strategies will vary based on location, studies examining the operationalization of interventions can guide the uptake and maintenance of interventions in other EDs.

Many questions regarding logistical barriers and catalysts to implementation remain. For instance, who should deliver the intervention (eg, physician, nurse, social worker, case manager, patient navigator)? Our literature review found that social workers, case managers, and resource navigators tended to be responsible for implementing ED-based social needs interventions.[26,27,30,33,-35,37,38,40-46] No study directly compared the uptake of an intervention based on whether members of the clinical team (eg, physicians, nurses) or ancillary staff (eg, social workers, case mangers) delivered the intervention. Expert reviewers emphasized the need to assess which staff should be involved and how interventions should be structured. Participants also emphasized staffing limitations as a barrier to uptake and the need for support staff to be included in future research designs and methods.

Studies examining the timing of the intervention during the ED visit (eg, waiting room, in the exam room, post-ED visit), the burden of intervention documentation, how the intervention affects length of stay, and whether the intervention increases task burden will be essential for the uptake of and adherence to the intervention. After incorporating all feedback, the final research priorities are as follows, with the first ranking medium priority and the second ranking high priority:

1. How can EDs reduce barriers (eg, clinician/staff burnout, ED length of stay, electronic health record (EHR)/documentation burden) and increase acceptance of interventions?
2. How can EDs integrate interventions into ED operations to increase feasibility and sustainability? Are existing staffing models sufficient to support the pragmatic implementation of interventions?

Gap 3: Engagement with Medical and Social Systems

The final research gap, engagement with medical and social systems, arose during conference discussions on the use of technology in interventions. The initial gap and associated research questions proposed by our workgroup focused on different technology used in interventions (Appendix B). Our literature review found that most interventions relied on phone calls, made either by patients or non-clinical staff, to link patients with resources.[26,27,35,37,38,41,43-46] Four studies reported interventions integrated into the EHR in some manner.[27,40,44,45] Two studies examined the benefit of using texting for linkage to community resources.[28,46] However, expert reviewers were more interested in whether interventions linked patients with resources, as well as EDs with larger health and social systems, rather than the technology used for linkage. For example, they felt it was more important to know that an intervention establishes communication between the ED and the organization providing services to patients rather than whether they used phone calls, faxing, a phone app, EHR referrals, or another form of technology.

Like the expert reviewers, participants in the conference discussion highlighted the need for good communication between patients and medical or social resources, and between the ED and other community resources (eg, food banks, shelters), the larger health system (eg, primary clinics, pediatric clinics), emergency medical services (EMS), and local government. Again, the emphasis was more on facilitating communication between stakeholders, rather than the technology itself. One participant commented that while EDs present an opportunity to address

social needs, EDs do not exist in a silo; interventions will not succeed without buy-in from and communication with the larger health and social systems. These discussions led to a revision of our initial technology-focused questions into communication-focused questions:

1. How can interventions be tailored to increase patient linkage with resources and facilitate monitoring of outcomes? What forms of technology may be useful?
2. Which interventions increase communication, coordination, and collaboration between EDs, their larger hospital or health systems, EMS, community partners, social services, local government, and other systems? How can EDs provide warm handoffs to these systems?

CONCLUSION

While the medical community has more recently recognized and advocated for addressing social risk and needs in clinical settings, research regarding interventions for ED patients is scarce. Work during the 2021 SAEM Consensus Conference identified and prioritized gaps regarding intervention outcome measures, implementing interventions in the busy ED environment, and communication between and within health and social systems. The research gaps and priorities identified during the Consensus Conference offer guidance for further work to establish effective interventions and build relationships with community health and social systems to reduce the social risk and address the social needs of our patients.

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2021 SAEM Consensus Conference Proceedings: Research Priorities for Implementing Emergency Department Screening for Social Risks and Needs

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Introduction: Despite literature on a variety of social risks and needs screening interventions in emergency department (ED) settings, there is no universally accepted or evidence-based process for conducting such interventions. Many factors hamper or promote implementation of social risks and needs screening in the ED, but the relative impact of these factors and how best to mitigate/leverage them is unknown.

Methods: Drawing on an extensive literature review, expert assessment, and feedback from participants in the 2021 Society for Academic Emergency Medicine Consensus Conference through moderated discussions and follow-up surveys, we identified research gaps and rated research priorities for implementing screening for social risks and needs in the ED. We identified three main knowledge gaps: 1) screening implementation mechanics; 2) outreach and engagement with communities; and 3) addressing barriers and leveraging facilitators to screening. Within these gaps, we identified 12 high-priority research questions as well as research methods for future studies.

Results: Consensus Conference participants broadly agreed that social risks and needs screening is generally acceptable to patients and clinicians and feasible in an ED setting. Our literature review and conference discussion identified several research gaps in the specific mechanics of screening implementation, including screening and referral team composition, workflow, and use of technology. Discussions also highlighted a need for more collaboration with stakeholders in screening design and implementation. Additionally, discussions identified the need for studies using adaptive designs or hybrid effectiveness-implementation models to test multiple strategies for implementation and sustainability.

Conclusion: Through a robust consensus process we developed an actionable research agenda for implementing social risks and needs screening in EDs. Future work in this area should use implementation science frameworks and research best practices to further develop and refine ED screening for social risks and needs and to address barriers as well as leverage facilitators to such screening. [West J Emerg Med. 2023;24(2)302–311.]

INTRODUCTION

Adverse social determinants of health, which encompass a host of socioeconomic and behavioral factors, are primary drivers of illness and injury.[1] The set of adverse social factors linked to an individual's poor health is referred to as their "social risk," while their expressed priorities and desires for assistance addressing their social risks are collectively referred to as their "social need."[2,3]

The emergency department (ED) provides a unique and important setting for social risks and needs screening and intervention to provide higher value care.[4] Social risks and needs such as housing instability, food insecurity, lack of employment, substance use, and transportation barriers are prevalent in the ED patient population.[5–9] Furthermore, approximately a quarter of adults in the United States lack a usual source of medical care.[10] This group, particularly those uninsured or enrolled in Medicaid, often relies on the ED when health issues arise,[11] highlighting a need for the ED to provide screening and resources that many patients are unable to access elsewhere. However, many factors affect the implementation of social risks and needs screening in the ED, including screening tool characteristics and deployment, stakeholder perspectives on screening, characteristics of the clinical, reimbursement, and regulatory environments, and the selected implementation strategies.[12] The impact of these factors on screening implementation and uptake is inadequately characterized. A better understanding of the components and steps involved in implementing efficient and impactful ED-based social risks and needs screening programs could facilitate the uptake of this important tool for addressing the social determinants of health.

To spur research on ED-based social risks and needs screening, the 2021 Society for Academic Emergency Medicine (SAEM) Consensus Conference, "From Bedside to Policy: Advancing Social Emergency Medicine and Population Health through Research, Collaboration and Education" ("Consensus Conference") developed a research agenda based on literature gaps, expert opinion, and stakeholder feedback comprising the following: 1) instruments for social risks and needs screening in the ED; 2) implementation of social risks and needs screening in the ED; and 3) interventions for patients with identified social risks and needs in the ED. Our goal in this article, the second of three manuscripts, was to describe consensus, process-derived research gaps and priorities related to *implementation* of social risks and needs screening in the ED setting.

METHODS

We identified research gaps and priorities for ED-based social risks and needs screening instruments, implementation, and interventions through a consensus-based approach, drawing on an extensive literature review, expert consultation, and feedback from Consensus Conference participants during moderated discussions and follow-up surveys (Figure 1).

Population Health Research Capsule

What do we already know about this issue?
The ED is an important setting for social risks/ needs screening and intervention, yet factors affecting screening implementation are poorly characterized.

What was the research question?
What are the research gaps and priorities related to implementation of social risks/needs screening in the ED setting?

What was the major finding of the study?
Major comparison with p-value and confidence interval
In a consensus process, we developed and ranked 12 research questions to address three social risks/ needs screening implementation knowledge gaps.

How does this improve population health?
We highlight research needed on the design, structure, and operationalization of ED social risks/needs screening to increase program sustainability and patient benefit.

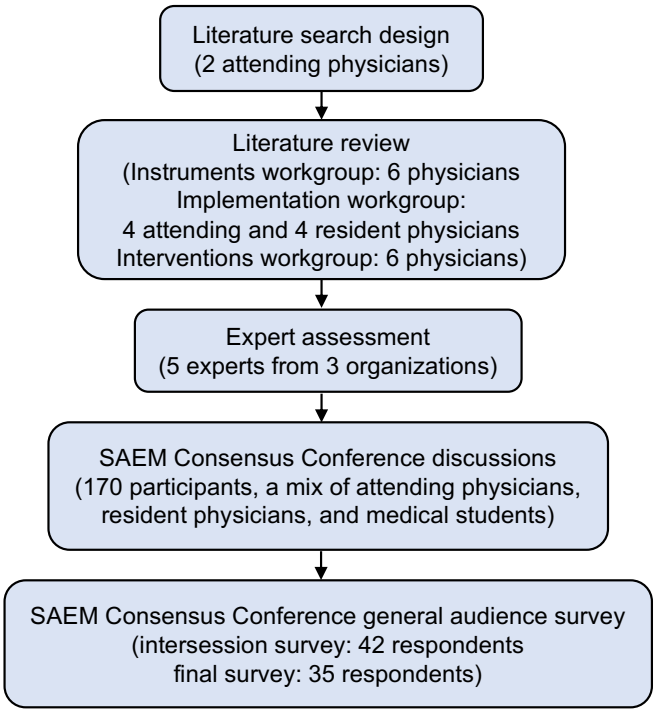

Figure 1. 2021 Society of Academic Emergency Medicine (SAEM) Consensus Conference process for identifying research gaps and priorities for implementation of emergency department-based social risks and needs screening.

Literature Review

A literature review on social risks and needs screening in the ED, adapted from methods used by Malecha et al[5] and in consultation with a social sciences librarian, identified 2,085 articles covering screening tools, implementation, and/or interventions (Figure 2). Based on relevance of titles and abstract content, we selected 151 articles for detailed review. We found another 188 articles using the search term "emergency" in the Social Interventions Research & Evaluation Network (SIREN) Evidence and Resource Library[13] and selected 22 for detailed review. Both searches were conducted in December 2020. Of the 173 articles identified for detailed review, 75 addressed implementation of ED screening, focusing on screening format and workflow, team structure, and barriers and facilitators to screening implementation.

Finally, five additional articles from bibliographic references of the reviewed manuscripts were added to the literature review, based on their pertinence to ED screening implementation. A team of four attending and four resident physicians, all in Emergency Medicine, reviewed the 80 articles and extracted details into an Excel for Mac, version 16.52 (Microsoft Corp, Redmond, WA) database with information on study objective, design, outcomes, results, limitations, and quality. Our workgroup analyzed the extracted data and source manuscripts with the primary goals to identify research gaps and to subsequently draft research priorities.

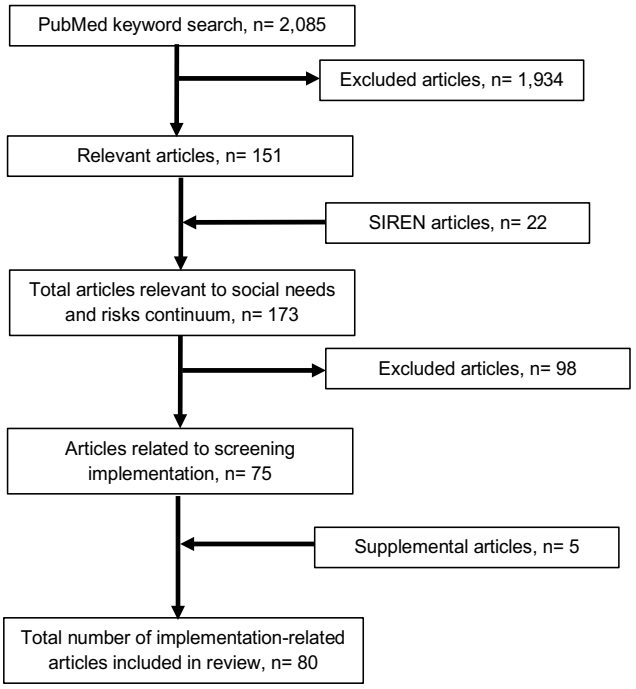

Figure 2. Flow diagram of literature review search results. *SIREN,* Social Interventions Research & Evaluation Network.

Engagement and Feedback

We shared these draft research priorities with a panel of experts drawn from three organizations: the Office of the Assistant Secretary for Planning and Evaluation, a health policy-focused government agency[14]; Health Leads, a nonprofit organization connecting communities to social resources[15]; and SIREN, a program at the University of California San Francisco that researches healthcare sector strategies to address social conditions.[13] We integrated feedback from these experts into a pre-reading document shared with Consensus Conference participants.

The SAEM Consensus Conference was held virtually using Zoom sessions (Zoom Video Communications, San Jose, CA) on April 13 and 27, 2021. The first session included a moderated discussion of methods, research gaps, and preliminary research priorities that incorporated expert feedback regarding the implementation of social risks and needs screening in the ED. After the first session, an intersession survey gathered feedback from the Consensus Conference participants, and this feedback was integrated into a revised set of research priorities. In the second session, moderated discussion further refined the priorities and ratings and resulted in a revised list of research priorities. In a final survey after the second session, participants ranked research priorities based on their perceived importance for future research and the SMART (specific, measurable, attainable, relevant, and time-based) criteria. Priorities were ranked using the following formula:

3 x (# of 1st choice votes) + 2 x (# of 2nd choice votes) + 1 x (# 3rd choice votes) = Total Score

We categorized research priorities as high, medium, or low priority based on relative score (top ⅓, middle ⅓, lowest ⅓, respectively). Below, we present the research priorities pertaining to implementation of social risks and needs screening, grouped by thematic gaps identified during the literature review.

RESULTS AND DISCUSSION

Of the 80 articles reviewed, 10 were controlled clinical trials, including eight randomized controlled clinical trials, and five were prospective observational studies. Following the first moderated discussion, 31/32 survey respondents (96.8%) found that no additional priorities should be added to the research question list, and 28/32 (87.5%) recommended that no priorities be removed. Following the second Consensus Conference moderated discussion, 35 respondents completed the second survey, generating the final ranked list of research gaps and priorities, summarized in the Table and discussed in detail below.

Gap 1: Screening Implementation Mechanics

Our literature review and Consensus Conference discussion identified several research gaps in the specific mechanics of

Table. Final ranked research priorities pertaining to implementation of social risks and needs screening in the emergency department. Total points are weighted (3 points for priority 1 vote, 2 points for priority 2 vote, and 1 point for priority 3 vote).

Question	Priority 1	Priority 2	Priority 3	Total points	Priority category	Gap addressed*
How can EDs work effectively with and leverage existing expertise and resources of community organizations to optimize ED screening for social risk/needs?	10	3	4	40	High	OCE
What combination of interpersonal engagement and technology (eg, chatbots, kiosks, and EHR alerts and algorithms) in the screening process optimizes patient comfort disclosing their needs, maximizes efficiency, and facilitates successful referrals to community resources?	3	11	1	32	High	SIM
When should the screening be completed during the ED course? Where/how should it be done (eg, triage desk, registration, or alone in a treatment room; technology-assisted)? Where and with whom are results of screening discussed?	7	3	4	31	High	SIM
What are patient-, clinician-, and systems-level barriers to social risk/need screening in the ED? What strategies can be used to address the barriers to screening for social risk/needs in the ED? Do patient and clinician acceptability and accurate completion of screening improve when these barriers are addressed?	3	7	2	25	High	BFS
What is the ideal team structure and skill-mix of personnel for supporting screening in the ED? How might community health workers, trained peers, and/or health system navigators be incorporated into the screening process?	2	2	4	14	Medium	SIM
What is the comparative effectiveness of conducting a brief screening (eg, 1-2 items) for social risk/needs and then more detailed questions for those with potential risks/needs identified in the general screener versus starting with a more comprehensive screening for multiple discrete social risk/needs?	3	1	2	13	Medium	SIM
What is the "return on investment" for social risk/need screening in the ED, considering broadly defined "returns" as well as costs (including time and resources) in the ED?	0	3	7	13	Medium	BFS
How does the effectiveness of a given ED-based, social risk/need screening intervention vary across settings (ie, urban vs rural, academic vs community, and across multiple sites in general)? How can implementation of screening for social risk/needs be tailored based on setting to maximize effectiveness?	4	0	0	12	Medium	OCE
What strategies should be used to screen for social risk/needs among patients with psychiatric or high acuity presentations? Non-English-speaking patients? Undocumented patients?	0	3	5	11	Low	BFS
What is the comparative effectiveness and feasibility of strategies where interventions are triggered by positive social risk/need screening versus universal offers of social needs assistance to ED patients?	2	0	2	8	Low	SIM
What is the role of universal screening vs targeting certain patient groups (eg, patients with frequent ED visits)?	1	1	1	6	Low	SIM
What factors of the payment and policy landscape (eg, mandates and funding) encourage/incentivize or discourage EDs from implementing social risk/need screening?	0	1	2	4	Low	BFS

**SIM,* screening implementation mechanics (Gap 1); *OCE,* outreach and community engagement (Gap 2); *BFS,* barriers and facilitators to screening (Gap 3); *ED,* emergency department; *EHR,* electronic health record.

screening implementation, including screening and referral team composition, workflow, and use of technology. Literature on social risks and needs screening describes the feasibility of, and potential concerns with, several team structures and workflows, including screening questions asked by ED staff (eg, registration clerk, nurse, social worker),[16–20] completed independently by patients,[16,18,21–27] or asked by external personnel (eg, patient navigator).[25,26,28,29]

Social risks and needs screening questions may be embedded in the electronic health record (EHR) and asked by ED staff in series with more conventional questions (eg, contact information, medical history, current symptoms).[30] While this approach may integrate with the existing workflow and make use of staff already interacting with the patient, there may be a tendency by staff to rush or skip some questions given time constraints and the large volume of EHR prompts.[23]

Screenings completed independently by the patient often use electronic platforms such as tablets, kiosks, or chatbots.[16,21,23–26,31,32] Such patient-facing, technology-based

platforms can improve disclosure of risks/needs compared with face-to-face screening,[18,21,27,33] especially in the ED waiting room and other spaces with limited privacy.[2,18,34] Because these platforms do not require continuous staff time, screening can be more comprehensive, and patients have more autonomy over which questions to answer. Electronic screening can also automate referrals.[28] Patient acceptance of self-facilitated, technology-based screening depends on patient age and screening topic; use of digital technologies is near-ubiquitous among adolescents,[34] and most adolescents prefer technology-based screening for most social risk and need topics.

In 2000, increasing age was associated with lower acceptability of technology-assisted screening[35]; further studies could determine whether this sentiment persists and identify barriers to overcoming technological barriers among older adults. Another research gap is how technology might increase or impede screening accessibility for patients with vision or hearing impairments, limited English proficiency, and/or low health literacy. Furthermore, there is an opportunity for such research to include partnerships with patients in the co-design of accessible screening tools.

Several studies describe screening programs led by non-clinical staff and volunteers who can facilitate both screening and navigation to resources for identified needs ("patient navigator" model).[36–39] Programs that specifically employ peer navigators and community health workers can incorporate community perspectives to better design screening programs, increasing patient comfort with disclosing needs, and empowering members of the community with new skills and opportunities.[40] As with patient-completed questionnaires, screening not embedded within the EHR may lack EHR integration, and whether and how this information might be useful to clinicians and tracked over time is unstudied.

Consensus Conference participants broadly agreed that social risks and needs screening is generally acceptable to patients and clinicians and feasible in an ED setting. They therefore advocated that future research focus more on using best practices from quality improvement and implementation science to select and customize screening models to meet the needs of a local context, maximize the value of screening to patients and clinicians, and enable long-term sustainability of screening programs. For those new to quality improvement and implementation science, these practices may include using qualitative and quantitative methods to understand contextual factors and stakeholder perspectives, constructing testable theoretic and system models, and characterizing barriers and facilitators to initiating, scaling up, and sustaining screening.[41–43] Additionally, researchers could plan experiments using one of many implementation research designs to evaluate screening deployment strategies through a combination of process and outcome metrics.[44–46]

Reflecting on the various models for screening, Consensus Conference participants expressed concern that screenings facilitated by overextended clinicians or nursing staff would be unsustainable regardless of buy-in and recommended research evaluating the screening by non-clinical staff (eg, peer navigators or college students) and/or training existing team members with nonclinical roles (eg, registration staff). Participants suggested clinicians would appreciate access to screening *results* even if they are less interested in doing the screening themselves. Participants recognized that many EDs have generally relied on social workers to address social needs of high-risk patients identified by clinicians and recommended that social workers be involved in the design and implementation of screening programs. Regardless of the screening model chosen, participants said it was essential for ED staff initiating or facilitating screening to understand and convey to patients the importance and utility of screening and demonstrate empathy throughout the process – an approach that may require additional training.

Research Priorities:

1. When should the screening be completed during the ED course? Where/how should it be done (eg, triage desk, registration, or alone in a treatment room; technology-assisted)? Where and with whom are the results of screening discussed?
2. What is the ideal team structure and skill-mix of personnel for supporting screening in the ED? How might community health workers, trained peers, and/or health system navigators be incorporated into the screening process?
3. What combination of interpersonal engagement and technology (eg, chatbots, kiosks, and EHR alerts and algorithms) in the screening process optimizes patient comfort disclosing their needs, maximizes efficiency, and facilitates successful referrals to community resources?
4. What is the comparative effectiveness of conducting a brief screening (eg, 1-2 items) for social risks/needs and then more detailed questions for those with potential risks/needs identified in the general screener versus starting with a more comprehensive screening for multiple discrete social risks/needs?
5. What is the comparative effectiveness and feasibility of strategies where interventions are triggered by positive social risks/needs screening versus universal offers of social needs assistance to ED patients?
6. What is the role of universal screening versus targeting certain patient groups (eg, patients with frequent ED visits)?

Gap 2: Outreach and Community Engagement

The literature includes numerous examples of engagement between social risks and needs screening programs and external agencies, including community-based organizations (CBOs) and referral agencies, especially for linking patients with

resources.[23,28,36,47–50] Relationships with referral agencies and CBOs have so far been useful for refining screening tools,[23] evaluating referral success,[49] and sharing patients' experiences.[50] However, we found no studies that directly involved patients or CBOs in the *design* of ED screening processes.

During the Consensus Conference, participants discussed community outreach and engagement to 1) enhance bidirectional communication with referral agencies, and 2) make screening processes more patient-centered. Participants thought community partners could help tailor screening processes to particular settings (eg, rural areas, language minorities) and advise on the timeline and manner of screening. Furthermore, it was thought that involving referral agencies in program design could help these agencies better anticipate increased demand following screening implementation and help tailor the screening process to better match agencies' purpose and capacity.

While some Consensus Conference participants advocated for a community-based participatory research approach to developing and implementing ED social risks and needs screening, we found no studies using this approach. Through such an approach, representatives from socially vulnerable communities could lead design of screening interventions centered on patients' priorities; gather screening information (eg, through a community health worker approach); recommend resources that are most useful and referral agencies that are most trusted among the community; review and contextualize aggregate results (eg, trends in screening, numbers and types of referrals to various kinds of resources with community partners); and help evaluate and improve the program.[51,52]

Research Priorities:

1. How can EDs work effectively with and leverage existing expertise and resources of community organizations to optimize ED screening for social risks/needs?
2. How does the effectiveness of a given ED-based social risk/needs screening intervention vary across settings (ie, urban vs rural, academic vs community, and across multiple sites in general)? How can implementation of screening for social risks/needs be tailored based on setting to maximize effectiveness?

Gap 3: Barriers and Facilitators to Screening

Our working group identified patient, personnel, system, and societal barriers to implementation of ED social risks and needs screening. Our literature review identified barriers and strategies to overcome these barriers and demonstrated research gaps that were further discussed and prioritized by Consensus Conference participants.

Patient-Related Barriers to Emergency Department Social Risks and Needs Screening

A variety of patient-related barriers to ED social risks and needs screening have been reported. Patient condition (eg, high-acuity illness, impairment) during the ED visit may limit screening of certain patients.[53] Among patients able to be screened, those in hallway beds or other open areas may feel uncomfortable sharing screening information aloud.[54] Others may be concerned about sharing information with unknown or untrusted referral organizations[54] or triggering a report to Child Protective Services by disclosing certain risks (eg, intimate partner violence [IPV]).[55] Furthermore, patients may decline screening due to disinterest in receiving resources.[56] Factors that may facilitate screening in the ED include caring and empathetic interactions with screening staff, ability to immediately address identified needs,[55] reassurance that screening will not delay care, assistance with screening technology, and observing that other patients are also screened.[16] We found no studies that attempt to show the effect of addressing these barriers and facilitators on completion of screening, willingness to disclose risks and needs, or on accessing resources.

Consensus Conference participants described the lack of an ongoing patient-clinician relationship as a unique challenge for ED social risks and needs screening, highlighting a need for research to address which screening team structure (eg, clinical staff, peer navigators) is best for building trust to enable disclosure of social risks and needs and enable linkages to desired resources.

Personnel-Related Barriers to Emergency Department Social Risks and Needs Screening

Clinicians generally understand that social risks impact health,[4] and most studies show clinical staff supporting the idea of screening [2,54,57] with greater support among physicians than nurses.[31] Furthermore, attitudes toward screening can improve following implementation of screening programs.[58] Clinical staff have also expressed reservations about screening, including a belief that screening is beyond their scope of practice,[59,60] fear of offending patients,[28,55,59,61,62] perceived or real lack of resources to address needs,[55,62,63] and concern about disclosure increasing risk such as with IPV.[59] In the case of IPV screening, however, evidence shows patient acceptability[23,53,54] and satisfaction[64] along with a single study finding no risk of violence with disclosure.[65] Literature suggest several factors that may increase staff support for screening, including leveraging technology during screening[60]; selecting nurse champions to help direct implementation[16]; using a team approach to screening[60]; and ongoing staff engagement and feedback.[16] Incentives for completing screening and disciplinary action for not screening have yielded mixed success,[57,66] and staff-centered educational interventions alone to improve screening completion have shown limited efficacy.[21,63]

Consensus Conference participants noted that preparation for screening implementation often centered on training

facilitators in content (eg, domestic violence, human trafficking), while insufficiently addressing critical system aspects such as funding, time, space, community engagement, and communication with referral agencies.

Systems-Related Barriers to Emergency Department Social Risks and Needs Screening

Our literature review identified multiple systems-level barriers to implementing social risk screening in the ED, including time constraints[2,55,61,62,67,68]; lack of established processes for addressing abuse[16,67,69]; and concern that screening may shift important ED resources away from acute care, lengthen ED stays, increase unreimbursed costs, and/or not be connected with appropriate interventions.[70] Furthermore, while technology has the potential to make screening more efficient, certain "low-lift" technology strategies such as EHR alerts have not appreciably improved screening completion.[17] Overall department culture and philosophy may also oppose social risk screening and challenge implementation.[67]

Consensus Conference participants noted that both rigorous quality improvement and implementation science begin with identifying local barriers to and facilitators for program success. Some participants recommended specific implementation frameworks, such as Exploration, Preparation, Implementation, and Sustainment[71] and the Consolidated Frameworks for Implementation Research,[12] as well as tools such as an Ishikawa diagram to identify factors within the local context contributing to efficient and accurate completion of screening and referral.[72]

Societal Barriers and the Payment/Policy Landscape

As insurance companies increasingly support value-based care, interest in addressing social determinants of health outside the hospital may increase. A current research gap is how payers and health systems can collaboratively address social risks and how to fairly attribute and compensate credit for successful interventions. We found no published literature evaluating the return on investment or cost-effectiveness for social risks screening in the ED, or on how incentives or mandates affect screening uptake. Participants identified incentives and regulation as critical to widespread implementation and called for rigorous studies (eg, multisite randomized control trials) demonstrating the ability for ED screening to ascertain and address patient social needs in order to justify these incentives and regulations.

Research Priorities:

1. What are patient-, clinician-, and systems-level barriers to social risks/needs screening in the ED? What strategies can be used to address the barriers to screening for social risks/needs in the ED? Do patient and clinician acceptability and accurate completion of screening improve when these barriers are addressed?
2. What is the "return on investment" for social risks/needs screening in the ED, considering broadly defined "returns" as well as costs (including time and resources) in the ED?
3. What strategies should be used to screen for social risks/needs among patients with psychiatric or high-acuity presentations? Non-English-speaking patients? Undocumented patients?
4. What factors of the payment and policy landscape (eg, mandates and funding) encourage/incentivize or discourage EDs from implementing social risk/need screening?

Types of Studies Needed

Consensus Conference discussions identified the need for studies using adaptive designs or hybrid effectiveness-implementation models to test multiple strategies for implementation and sustainability, in part to justify large-scale funding to make screening routine. Mixed-methods studies were also encouraged to show not just feasibility but how and why screening works and how these interventions can be sustained.

LIMITATIONS

This paper describes the series of activities leading to development of a research agenda on implementation of ED-based screening for social risks and needs as well as the research agenda itself. Although an extensive literature review was conducted at the beginning of this process, it was not designed as or intended to be a comprehensive systematic review. There is potential for omission of published or unpublished studies that might pertain to some of the research questions ultimately proposed. Furthermore, evidence was examined for quality, but no formal scoring with risk-of-bias tools was performed, as the goal was not to perform a systematic review but rather a focused, structured literature review to inform the consensus process. Another potential limitation is that the opinions and relative prioritization of research questions by the Consensus Conference participants could differ from opinions held by practitioners in the field more broadly.

CONCLUSION

This paper presents research gaps and priorities in implementing ED social risks and needs screening identified using an iterative, consensus-based approach involving an extensive literature review, expert assessment, and feedback from participants in the 2021 SAEM Consensus Conference. While there is much to learn about the efficiency and efficacy of different ED-based social risks and needs screening modalities, literature to date has shown that screenings are acceptable to patients and lead to their engagement with interventions.[26,38,73] We highlight a need for more collaboration with various stakeholders in screening design

and implementation. This engagement should be paired with rigorous evaluation of screening implementation processes to identify best practices, particularly for patients from diverse groups, ensuring that all patients receive evidence-based interventions to improve social risk and health outcomes.

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Characteristics of Emergency Medicine Specimen Bank Participants Compared to the Overall Emergency Department Population

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Introduction: Biorepositories lack diversity both demographically and with regard to the clinical complaints of patients enrolled. The Emergency Medicine Specimen Bank (EMSB) seeks to enroll a diverse cohort of patients for discovery research in acute care conditions. Our objective in this study was to determine the differences in demographics and clinical complaints between participants in the EMSB and the overall emergency department (ED) population.

Methods: This was a retrospective analysis of participants of the EMSB and the entire UCHealth at University of Colorado Anschutz Medical Center (UCHealth AMC) ED population across three periods: peri-EMSB; post-EMSB; and COVID-19. We compared patients consented to the EMSB to the entire ED population to determine differences in age, gender, ethnicity, race, clinical complaints, and severity of illness. We used chi-square tests to compare categorical variables and the Elixhauser Comorbidity Index to determine differences in the severity of illness between the groups.

Results: Between February 5, 2018–January 29, 2022, there were 141,670 consented encounters in the EMSB, representing 40,740 unique patients and over 13,000 blood samples collected. In that same time, the ED saw approximately 188,402 unique patients for 387,590 encounters. The EMSB had significantly higher rates of participation from the following: patients 18-59 years old (80.3% vs 77.7%); White patients (52.3% vs 47.8%), and women (54.8% vs 51.1%) compared to the overall ED population. The EMSB had lower rates of participation from patients ≥70 years, Hispanic patients, Asian patients, and men. The EMSB population had higher mean comorbidity scores. During the six months after Colorado's first COVID-19 case, the rate of consented patients and samples collected increased. The odds of consent during the COVID-19 study period were 1.32 (95% CI 1.26-1.39), and the odds of sample capture were 2.19 (95% CI 2.0-2.41).

Conclusion: The EMSB is representative of the overall ED population for most demographics and clinical complaints. [West J Emerg Med. 2023;24(2)312–321.]

INTRODUCTION

Personalized medicine can improve the care of patients with acute conditions.[1] Patients with genotype data may have treatments changed in the emergency department (ED) for conditions such as myocardial infarction and respiratory failure. For instance, clopidogrel is not recommended in one-third of myocardial infarction patients who are *CYP2C19*-poor metabolizers due to the risk of stent thrombosis,[2]

and succinylcholine should be avoided when a patient has a variant in *RYR1,* which predisposes to malignant hyperthermia.[3] However, there remains a shortage of data from patient populations with diverse ancestral backgrounds and acute care diagnoses needed to push discovery studies in acute care. Genome-wide association studies typically require 1,000 patients with a phenotype and 1,000 patients without to be adequately powered. There are not large cohorts with diverse ancestral backgrounds and a broad spectrum of clinical diseases to power acute-care personalized medicine studies.[4]

The largest biobanks in the United States (US) consist of primarily non-Hispanic White participants. For example, the Marshfield Medical Clinic biobank, the largest general biobank in the US, is composed of 98% non-Hispanic White participants,[5] and the Geisinger Biobank is composed of greater than 95% non-Hispanic White individuals.[6] The Vanderbilt University Medical Center BioVU biobank has slightly better diversity, with 75% of participants being non-Hispanic White.[7] While these demographics are representative of the populations surrounding the biobanks, their applicability to acute clinical situations is limited because they are not representative of the demographics typically cared for in EDs.[8] The *All of Us* program is the most diverse genomic enrollment biobank to date, although acute clinical data is not currently available through the program.[9] Inclusion of ancestrally diverse groups allows for capture of rare genetic variants that can cause discordant clinical responses in underrepresented minority groups.[10] Lack of diversity can limit the clinical applicability of findings resulting from the biobank data and can worsen the health inequities for minority groups seeking acute clinical care in EDs.

Emergency departments represent an untapped resource of ancestral and phenotypically diverse cohorts due to their increased demographic diversity and variety of acute health conditions encountered and treated, as compared to other clinic sites. In 2018, US ED visits were comprised of 53.1% non-Hispanic White, 26.5% non-Hispanic Black, 16.5% Hispanic (15.2% Hispanic-White, 0.9% Hispanic-Black, and 0.4% Hispanic-other).[11] Additionally, EDs across the nation diagnosed and treated almost 50,000 distinct health problems across 150 million patient visits. The variety of clinical diseases and drugs administered provide endless potential for personalized medicine discovery. The ED is a unique and ideal location for personalized medicine research to improve the care for a wide variety of patients and clinical conditions. However, the coronavirus disease 2019 (COVID-19) pandemic altered the demographics of patients presenting to EDs[12] and affected their willingness to participate in research.[13] Thus, we believe that examination of this potential confounding factor is necessary to interpret how research populations compare to overall clinical populations.

The Emergency Medicine Specimen Bank (EMSB) at the University of Colorado is the first large-scale biobank that seeks to enroll all patients in an acute care setting.[14] The EMSB facilitates research studies by pairing clinical data with biologic samples in a group of patients with acute illness with a broad range of clinical severity.[14] Our overall objective in this study was to compare the demographics and clinical conditions of those enrolled in the EMSB, accounting for how the COVID-19 pandemic affected representation, compared to the overall ED population from which the cohort was drawn.

Population Health Research Capsule

What do we already know about this issue?
The lack of ancestral and clinical diversity in biobanks can cause rare genetic variants to go unidentified, limiting the applicability of precision medicine in acute care conditions.

What was the research question?
Does the Emergency Medicine Specimen Bank (EMSB) reflect the diverse patient population in the ED?

What was the major finding of the study?
The EMSB enrolled fewer older Hispanic and Asian patients compared to the overall ED population (P-value<0.001).

How does this improve population health?
Non-English speaking patients are enrolled at a lower rate, although all clinical complaints are represented in acute care biorepositories.

METHOD

Clinical Setting and Patient Population

The EMSB is housed at the University of Colorado Hospital ED Anschutz Medical Campus (UC-AMC). The ED at this UC-AMC is a large-volume academic facility with approximately 100,000 visits annually, although in 2018 at the time the EMSB was initiated, volume was approximately 80,000 visits per year. UC-AMC is in Aurora, CO, adjacent to Denver, and is the second-largest city in the state.

Inclusion Criteria/Exclusion Criteria

The EMSB was initiated in the UC-AMC ED on February 5, 2018. Patients eligible for the EMSB include those presenting to UC-AMC who are >17 years of age, speak English or Spanish, and are medically stable to consent or have a medical durable power of attorney (MDPOA). The EMSB researchers and trained clinical staff approach all eligible patients for consent to participate in this biobank program. All patients who have an intravenous line (IV) placed as part of their routine care have a blood sample

collected, and the EMSB keeps samples from consented participants. Consent, sample collection, sample sorting, and sample processing occur in the ED.

The inclusion and exclusion criteria are outlined in the electronic health record (EHR) system used by UCHealth (Epic Systems Corporation, Verona, WI). Patients are excluded if their clinical condition precludes the ability to consent, and there is no MDPOA available. The consent lasts for a year after signing, allowing for collection of samples and clinical data from subsequent ED visits without additional consent.

Waiver of Consent and Institutional Review Board Approval

Obtaining traditional informed consent prior to sample collection is not feasible for all ED subjects because of the nature of the ED clinical interaction. To overcome this barrier, the EMSB operates under a temporary waiver of consent approval status,[14] which allows for collection of the blood samples during routine clinical draws, although the samples are only kept for research when matched with a consent, which occurs later in the ED visit. This protocol was approved by the Colorado Multiple Institutional Review Board and adheres to the ethical principles for medical research outlined in the Declaration of Helsinki.

Data Extraction

We examined three study periods: the peri-EMSB, January 12, 2017–January 13, 2019; the post-EMSB, February 5, 2018–January 22, 2022; and the COVID-19 era.

Peri-EMSB

Within the established time frame, our goal was to allow for examination of EMSB inclusion as compared to the overall ED population including detailed data on visit diagnoses and medications administered. This also allowed examination of the impact of EMSB implementation over time. We used our data warehouse, Health Data Compass, for data extraction. This de-identified dataset included detailed records of all *International Classification of Diseases, 10th Revision* (ICD-10) codes, chief complaints, and medication administrations, as well as basic demographic information such as age, race, ethnicity, and gender for all patients presenting to the ED.

Post-EMSB

As with the peri-EMSB period, this time frame allowed for examination of the demographics and clinical presentation of EMSB populations compared to the overall ED population. This data extraction allowed for examination of detailed clinical variables with total consent rates across the ED and the EMSB population from the inception of the EMSB on February 5, 2018, to the most recent data extraction on January 22, 2022. We used data collected under the EMSB protocol. The EMSB collects a limited dataset from all ED patients for preliminary hypothesis exploration but does not collect the detailed data obtained for the peri-EMSB cohort. The post-EMSB data allows for examination of changes over a longer time period and is more flexible than the peri-EMSB dataset. This data includes demographics (age, gender, race, and ethnicity), chief complaint, diagnosing *International Classification of Diseases, 10th Rev* (ICD-10) code, and time of sample. All clinical data available in the EHR can be extracted for EMSB consented patients under new specified ethics board-approved research protocols.

COVID-19

The COVID-19 pandemic had a major impact on who accessed healthcare and how healthcare was accessed. It also had an impact on the number of research staff who were available to enroll patients. Therefore, we examined enrollment specifically six months before (pre-COVID-19, September 1, 2019– February 29, 2020) and after the COVID-19 pandemic began (post-COVID, March 1–August 31, 2020). During this study period, we examined consent rates, sample collection rates, and the rate of patients approached for consent.

Statistical Analyses

The unit of analysis was the ED visit. We made comparisons between categorical variables using chi-square tests. Comorbidity scores were calculated using ICD-10 codes and the Elixhauser Comorbidity Index score tool.[9] We used ANOVA testing to compare Elixhauser scores between the two groups. We calculated the EMSB approach rate as the number of consented patients plus the number of declined patients/ number total patients in the ED. We then calculated consent rates as the number of consents/number approached patients. The sample collection rate was calculated as the number samples collected/number encounters involving consented patients. Each of these rates was calculated for each month in their respective time periods. We compared mean rates across study periods using ANOVA and odds ratios.

RESULTS

Peri-EMSB Study Period

In the peri-EMSB study period (January 12, 2017-January 13, 2019), there were 119,450 visits in the overall ED population and 7,120 visits consented to the EMSB. The proportion of White and Black patients was higher in the EMSB population compared to the overall ED population (Table 1). The greater representation of Blacks was primarily driven by Black men who were less likely to participate in the EMSB program (9.7% EMSB participant vs 10.3% overall ED population). There was a lower representation of Asians in the EMSB in comparison to the overall ED population, and this trend was also consistent across the post-EMSB study period (see below). The EMSB enrolled fewer patients >70 years in the peri-EMSB period, and this continued across all study periods (Table 2).

Table 1. Demographics of study population across study periods. Only unique medical record numbers counted for the demographics.

	Peri-EMSB		Post-EMSB		COVID-19 Period	
Demographic variable	EMSB consented N= 7,120	Overall ED population N=119,450	EMSB consented N=40,740	Overall ED population N=188,402	EMSB consented N=15,139	Overall ED population N= 59,251
Median age (IQR)	43 (28,56)	41 (27,55)	40 (29,57)	40 (28,57)	39 (28,55)	41 (28,57)
Male gender (%)	41.5	42.1	45.2	48.5	42.4	47.8
Race (%)						
American Indian or Alaskan Native	0.3	0.42	0.9	0.7	1.0	0.8
Asian	1.4	2.7	1.9	3.3	1.8	3.5
Black	22.2	20.2	20.9	20.6	26.4	23.6
Native Hawaiian or other Pacific Islander	0.2	0.29	0.2	0.2	0.5	0.4
White	50.6	48.0	52.3	47.8	46.6	45.1
More than one race	4.5	3.8	0.9	0.7	1.0	0.8
Other	19.1	21.9	22.4	24.5	22.4	24.6
Patient refused, or unknown	0.2	2.7	0.1	1.5	0.3	1.3
Hispanic ethnicity (%)	23.4	24.8	27.3	27.3	27.6	27.6

ED, emergency department; *EMSB,* Emergency Medicine Specimen Bank; *COVID-19,* coronavirus disease 2019; *IQR,* interquartile range.

Table 2. Age distribution of EMSB consents during the peri-EMSB (January 12, 2017–January 13, 2019), Post-EMSB (February 5, 2018–January 22, 2022), and COVID-19 (September 01,2019 – August 31, 2020) study periods.

	Peri-EMSB		Post-EMSB		COVID-19 Period	
Age range	EMSB population N=40,740	Overall ED population N=188,402	EMSB population N= 7,120	Overall ED population N=119,450	EMSB population N=15,139	Overall ED population N= 59,251
18-29	27.3%	25.1%	26.9%	25.0%	27.3%	25.7%
30-39	22.0%	20.6%	21.7%	20.6%	21.9%	21.3%
40-49	16.2%	15.5%	15.9%	15.3%	16.2%	16.1%
50-59	14.9%	14.0%	14.8%	13.8%	14.9%	14.4%
60-69	10.8%	11.0%	11.1%	11.1%	10.5%	11.2%
70-79	5.8%	6.7%	6.3%	6.8%	6.0%	6.8%
80+	2.8%	4.2%	3.2%	4.3%	3.1%	4.4%

EMSB, Emergency Medicine Specimen Bank; *ED,* emergency department; *COVID-19,* coronavirus disease 2019.

During the peri-EMSB study period, the chief complaints of the EMSB consented cohort were consistent with the overall ED population (Figure 1); abdominal pain (13% vs 10%) and chest pain (8% vs. 5%) were the most common in both the EMSB and the overall ED cohorts, respectively. Of the 50 most common chief complaints, 45 were shared across the groups. During this study period there were a total of 773,652 individual ICD-10 codes represented for 342,534 encounters. The ICD-10 codes were similar across the overall ED population and the EMSB consented groups; six of the 20 most common ICD codes were found in both the ED and the EMSB (Table 3). Patient encounters that were consented to the EMSB had higher Elixhauser comorbidity scores compared to the overall ED population (0.692 vs 0.262, respectively). The EMSB-consented encounters had Elixhauser scores ranging from -18 to 39 (median 0, IQR 1,0) while patients without EMSB-consented encountered had scores ranging from -19 to 39 (median 0, IQR -1,0).

Post-EMSB Study Period

During the post-EMSB study period (February 5, 2018–January 22, 2022), the UC-AMC saw 188,402 patients for 387, 590 encounters (Table 1). This population consisted of 47.8% White patients, over half were <60 years (78.2%), and a little over a quarter of patients were Hispanic (27.33%). These visits had a total of 38,127 diagnoses codes for 778 chief complaints. The median age was 40 years (interquartile range [IQR] 29, 57) in the EMSB and 40 years (IQR 28,

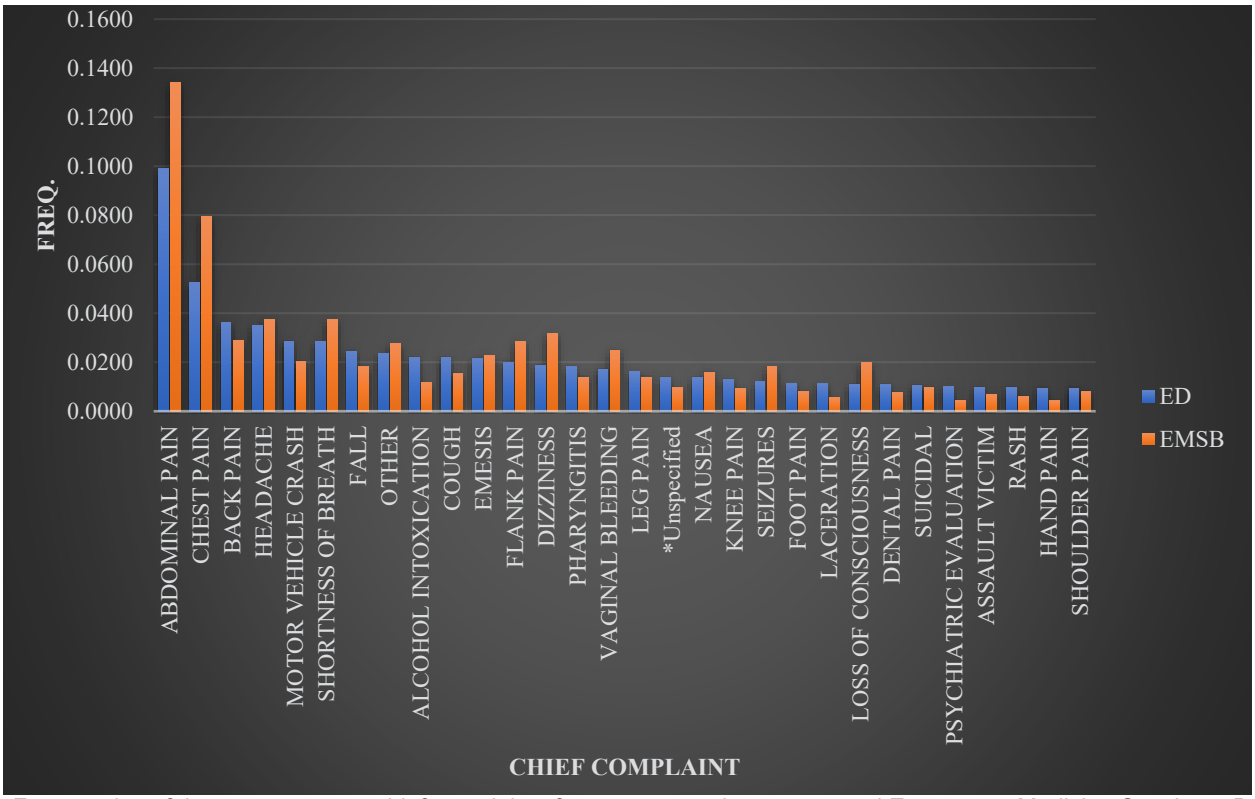

Figure 1. Frequencies of the most common chief complaints for emergency department and Emergency Medicine Specimen Bank (EMSB) encounters during the peri-EMSB study period.

57) in the general ED population. The proportion of EMSB participants aged 18-59 years were higher than the proportion of ED patients in the same age range (Table 2); the greatest number of patients seen in the ED and the greatest proportion of consented EMSB participants were in the 18- to 29-year-old range. There were, however, lower rates of consent in patients aged 70-81+ years. Only subjects within the 60-69 years age bracket had similar representation compared to the general ED population. Only about 9% of all EMSB consents come from patients ≥70.

The number of samples collected increased proportionally to the number of consented encounters (Figure 2) with >14,000 samples collected. The number of EMSB consents increased steadily over the study period; 36.7% of all patients presenting to the ED were consented to the EMSB at the end of the three study periods (Figure 3). The number of samples collected is lower than the number of consented encounters because samples are only drawn when a subject has an IV placed for clinical care; over the post-EMSB study period only 59.8% of EMSB consented visits had an IV placed.

Over the post-EMSB study period, the proportion of patients who declined to participate in the EMSB steadily decreased from a peak of about 36% of all ED patients in August 2018 to only 23.7% as of January 22, 2022 (Figure 3). The number of undocumented encounters that did not receive a consent or a decline documented increased from 34% in August 2018 to 39.6% on January 22, 2022. The proportion of females presenting to the ED for care was slightly higher than males, but a higher percentage of females were consented when compared to males (51.7% vs 56.7%).

The rate of participation in the EMSB for subjects of Hispanic ethnicity differed from that of the general ED population (23.3% vs 28.0%). This difference seemed to be primarily driven by Hispanic males; there was a lower rate of consent in male Hispanic patients in the EMSB program compared with the overall ED population (23.0% vs 26.3%). On the other hand, there was no significant difference in rate of participation compared with overall ED population for Hispanic females (27.9% vs 27.6%).

There were 13 languages in 10,231 non-English or Spanish-speaking encounters. The limited language availability of the EMSB consent form greatly influenced the underrepresentation of Asians. Only 54% of Asian ED patients spoke English making 46% of patients ineligible due to language alone.

COVID-19 Pandemic

In the stx months before the pandemic (pre-COVID), there were 44,113 ED visits by 36,182 patients with 16,934 patients approached (46.80%), There was a total of 10,431 consented patients (61.60%), and 748 specimens collected. In the six months after the COVID-19 pandemic began (post-COVID), there were 36,228 ED visits with 29,768 patients

Table 3. Frequency of top 20 International Classification of Diseases, 10th Revision diagnosis codes in the peri-EMSB study period.

ICD-10 Codes	Overall ED population, N = 159,899 (%)	EMSB Consented, n= 7,871 (%)
I10 Essential hypertension	21.0	21.2
F17.210 Nicotine dependence, cigarettes, uncomplicated	20.0	18.9
E11.9 Type 2 diabetes, without complication	8.8	13.5
F17.200 Nicotine dependence, uncomplicated	6.5	8.1
F41.9 Anxiety disorder, unspecified	3.3	6.4
M54.5 Low back pain	3.2	6.4
G89.29 Other chronic pain	3.2	6.0
J44.9 Chronic obstructive pulmonary disease	3.1	5.5
J45.909 Unspecified asthma, uncomplicated	2.9	5.1
M54.9 Dorsalgia, unspecified	2.9	5.1
I25.10 Atherosclerotic heart disease of native coronary artery without angina pectoris	2.4	4.2
F10.920 Alcohol use, unspecified with intoxication, uncomplicated	2.3	4.1
M54.2 Cervicalgia	2.2	3.9
J06.9 Acute upper respiratory infection, unspecified	2.2	3.8
J02.9 Acute pharyngitis, unspecified	2.0	3.6
F32.9 Major depressive disorder, single episode, unspecified	1.8	3.1
F10.129 Alcohol abuse with intoxication, unspecified	1.7	3.0
F10.120 Alcohol abuse with intoxication, uncomplicated	1.7	3.0
I50.9 Heart failure, unspecified	1.6	2.9
E78.5 Hyperlipidemia, unspecified	1.6	2.8

EMSB, Emergency Medicine Specimen Bank; *ICD,* International Classification of Diseases, 10th Rev.

seen, 13,911 patients approached (46.73%), 9,457 consented patients (67.98%), and 1,371 samples collected. There was no difference in the approach rate before or after the pandemic began (pre-COVID mean rate 0.47; COVID mean rate 0.47). The consent rate was higher in the COVID-19 period (pre-COVID mean rate 0.62; post-COVID mean rate 0.68)

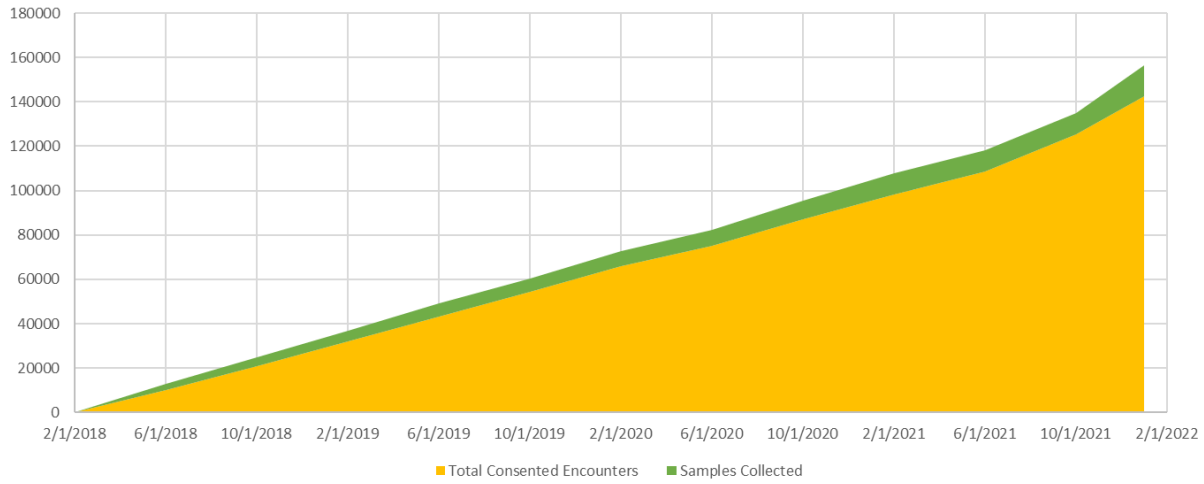

Figure 2. Samples collected for consented encounters increased at generally the same rate as the number of consented encounters. The frequency of consented encounters is found on the left vertical axis including a total of ~140,000 consented encounters over the first four years of the Emergency Medicine Specimen Bank program. The number of total samples collected was ~14,000 collected over this study period.

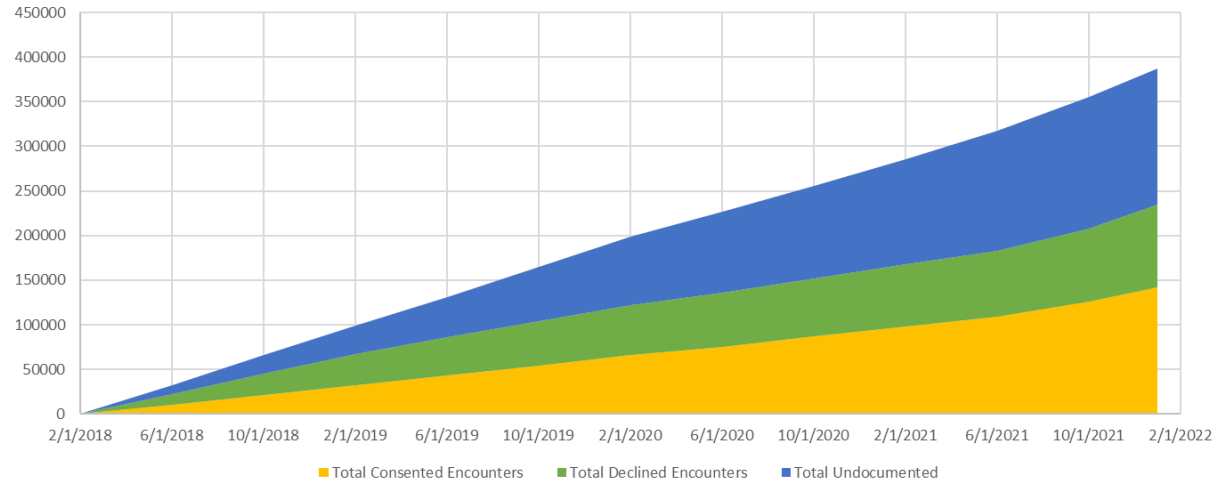

Figure 3. Rate of encounter consent, decline, and lack of documentation for Emergency Medicine Specimen Bank program. Over time, the number of all encounter types has increased. A steady increase in the number of consented encounters, increased rate of undocumented encounters, and decreased rate of declined encounters has been observed. The total number of emergency department visits over this period was ~300,000 encounters.

(Figure 4). The sample collection rate also increased in the post-COVID study period (pre-COVID mean rate 0.07; post-COVID mean rate 0.14). The odds of consent during the post-COVID study period were 1.32 (95% CI 1.26-1.39), and the odds of sample capture were 2.19 (95% CI 2.0-2.41).

DISCUSSION

The EMSB has increased enrollment and sample collection through integration into the standard clinical workflow. The 40,740 visits consented to this biorepository are largely representative of the ~188,400 ED patients, complaints, and diagnoses seen over the enrollment period. Additionally, the EMSB collected more than 14,000 whole blood samples from these patients over the same time from these subjects seen for emergent care. This patient and complaint diversity will allow for personalized medicine discovery studies that are already underway. This broad enrollment strategy has allowed the EMSB to provide clinical data and biologic samples for numerous studies including stroke, anti-emetic effectiveness, and COVID-19.[15,16]

While the age of the EMSB population is largely representative of the overall ED population, there was higher representation of younger participants. This was not unexpected as previous studies have described increased

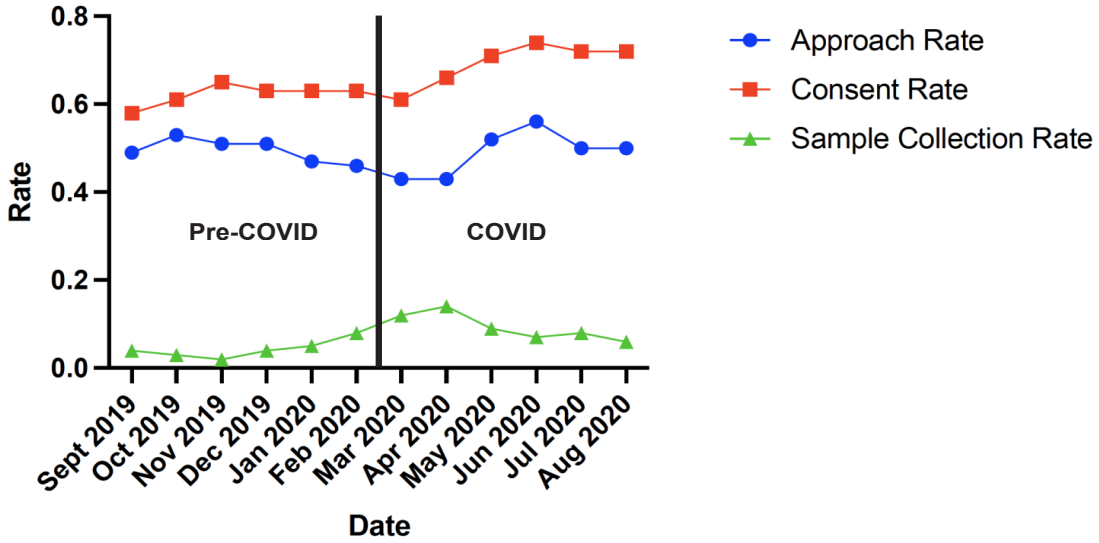

Figure 4. Consent, sample collection, and patient approach rates by month during the COVID-19 study period.

willingness of younger patients to participate in research.[17,18] We hypothesize that younger patients may have higher support for personalized medicine research and may be more willing to participate due to comfort with digital consent platforms.[19] There are fewer older participants consented to the EMSB, possibly due to increased frequency of advancing medical conditions.[18] When conditions such as hearing loss, vision loss, or dementia are present, this can increase the burden on staff in an informed consent process; therefore, fewer older subjects may be approached to participate.[19] Also, with increasing health concerns, older subjects may be unwilling to put themselves at additional perceived risk of participating in a research program.[17,20] We will address the age-based disparity in consent and participation within the EMSB moving forward with targeted enrollment strategies.

There is greater representation of women within the consented EMSB cohort, similar to other biobank programs, but varying from prior epidemiologic studies that demonstrate females, especially over the age of 50, have lower rates of participation in clinical trials and research follow-up.[17,18] On a global scale, there is greater support among women for personalized medicine research and biobanking programs compared to men,[19] which is supported by our data.

The EMSB participants have, on average, a higher comorbidity score than the overall ED population. While our analyses demonstrate that chief complaints are similar between EMSB consented and the overall ED population, consented patients may be more likely to have comorbid disease. This is likely because patients with more complex medical histories have longer ED stays and are more likely to have repeat visits and blood draws. These factors increase the opportunity for research staff to obtain consent for the biobank.

Our demographic data demonstrates systematic exclusion of some groups. Patients who are unconscious, are unable to consent due to their condition, or do not speak English or Spanish are not consented to the EMSB. While consent for one year after the index visit allows for capture of some subsequent visit data and samples, critically ill patients with only one visit are underrepresented in the EMSB. This may limit our ability to rapidly advance personalized medicine in some conditions. Furthermore, ED patients spoke 13 languages other than English and Spanish. These patients were also systematically excluded by the nature of the consent process. Over 10,000 patients were ineligible over the study period due to language exclusion, and this may have led to failure to capture rare genetic variants with high frequency in non-English/Spanish speaking ancestral populations. Translation into additional languages or utilization of interpreters could allow inclusion of these patients in the future, although that process may be too challenging for patients and research staff in this self-consent model. This research can be considered minimal risk, given that the data and samples are combined into large datasets and de-identified prior to analyses. This raises the question of whether consent is necessary for this design, given the implications for systematic exclusion of some demographic groups.

The COVID-19 pandemic altered the EMSB consent and sample collection processes. As of March 16, 2020, researchers without clinical responsibilities, including students and interns previously aiding in enrollment and prompting sample collection, were forced to work remotely to minimize their risk of contagion. This impeded the ability to consent patients in the ED or work with clinical staff for sample collection. Additionally, many new hospital processes and protocols were implemented to protect the clinic staff from illness. This resulted in fewer potential subjects being approached to participate in the biobank program, thereby increasing undocumented encounters and prompting us

to adjust our consent and sample collection workflow. Subsequently, the number of consents has increased, averaging around 50% of monthly ED encounters over the past year. Additionally, while subjects can sign a one-year consent, the number of consented encounters has risen, but without EMSB researchers on site to remind clinical staff to collect samples, the percent of samples collected compared with consented visits has declined. Despite this, it is encouraging that the proportion of declined encounters has steadily decreased since inception. The consent rate and sample collection rates increased significantly during the COVID-19 pandemic compared to the six months prior. This was likely due to increased patient and clinician interest in research paired with operational improvements to ease consent and sample collection.

LIMITATIONS

The English/Spanish language eligibility criteria particularly limited Asian recruitment in our ED; less than half of all Asians who were seen spoke English. Visits in which the patient was discharged or admitted quickly provided less time for patient consent. Even if consented, not all clinical complaints were well represented with a blood sample since many musculoskeletal injuries do not require an IV and thus don't provide a biologic sample. This may have limited our ability to capture genetic variants associated with analgesic effectiveness, for example. The EMSB cohort is biased toward including more severe clinical complaints that require longer work-up time in the ED. Also, while the EMSB aims to increase diversity and be representative of the ED patient population, the cohort is not entirely representative of the Denver area.

The population treated at the UC-AMC ED is still a majority White, although not as high as the Denver population (52.4% in UC-AMC ED, 80.9% in Denver County), and Blacks have greater representation (21.3% in UC-AMC ED, 9.8% in Denver County).[21] The location of the hospital may have contributed to this over-representation of Blacks, and in fact, increased the diversity in our enrollment.[4] Enrollment and sample capture processes have changed over time. Initially, there was excitement about the project, which led to high enrollment rates. Enrollment fell in the latter half of the first year of implementation. Providing increased education on the protocol and sharing study results with the clinical staff have been associated with increased enrollment rates in subsequent years.

CONCLUSION

The Emergency Medicine Specimen Bank is representative of the overall ED population for most demographics and clinical complaints. While barriers to inclusion remain, integration into clinical workflow was associated with increased consent and sample collection numbers. Enrollment in EDs can increase the diversity of patients and clinical conditions represented in biobanks.

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Impact of Ultrasonography on Chest Compression Fraction and Survival in Patients with Out-of-hospital Cardiac Arrest

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Introduction: Whether ultrasonography (US) contributes to delays in chest compressions and hence a negative impact on survival is uncertain. In this study we aimed to investigate the impact of US on chest compression fraction (CCF) and patient survival.

Methods: We retrospectively analyzed video recordings of the resuscitation process in a convenience sample of adult patients with non-traumatic, out-of-hospital cardiac arrest. Patients receiving US once or more during resuscitation were categorized as the US group, while the patients who did not receive US were categorized as the non-US group. The primary outcome was CCF, and the secondary outcomes were the rates of return of spontaneous circulation (ROSC), survival to admission and discharge, and survival to discharge with a favorable neurological outcome between the two groups. We also evaluated the individual pause duration and the percentage of prolonged pauses associated with US.

Results: A total of 236 patients with 3,386 pauses were included. Of these patients, 190 received US and 284 pauses were related to US. Longer resuscitation duration was observed in the US group (median, 30.3 vs 9.7 minutes, P<.001). The US group had comparable CCF (93.0% vs 94.3%, P=0.29) with the non-US group. Although the non-US group had a better rate of ROSC (36% vs 52%, P=0.04), the rates of survival to admission (36% vs 48%, P=0.13), survival to discharge (11% vs 15%, P=0.37), and survival with favorable neurological outcome (5% vs 9%, P=0.23) did not differ between the two groups. The pause duration of pulse checks with US was longer than pulse checks alone (median, 8 vs 6 seconds, P=0.02). The percentage of prolonged pauses was similar between the two groups (16% vs 14%, P=0.49).

Conclusion: When compared to the non-ultrasound group, patients receiving US had comparable chest compression fractions and rates of survival to admission and discharge, and survival to discharge with a favorable neurological outcome. The individual pause was lengthened related to US. However, patients without US had a shorter resuscitation duration and a better rate of ROSC. The trend toward poorer results in the US group was possibly due to confounding variables and nonprobability sampling. It should be better investigated in further randomized studies. [West J Emerg Med. 2023;24(2)322–330.]

INTRODUCTION

Chest compressions, the most important maneuver during cardiopulmonary resuscitation (CPR), generate cardiac output and maintain vital organ perfusion.[1] Interruption of chest compressions impairs coronary and cerebral perfusion and compromises the outcome of resuscitation.[2,3] High quality CPR with minimized interruptions is a cornerstone of successful resuscitation for patients with cardiac arrest (CA). Current resuscitation guidelines recommend that a single pause for a pulse check should not exceed 10 seconds.[4]

Chest compression fraction (CCF), an index indicator for the quality of CPR, is defined as the proportion of the time spent providing chest compressions during the whole CPR process. A positive benefit from CCF on the rate of return of spontaneous circulation (ROSC) was reported, although the ceiling effect of CCF was at 80%.[4-6] A variety of actions or procedures were related to interruptions of chest compressions, such as pulse checks, defibrillation, intubation, change of personnel performing the compressions, application of CPR adjuncts, etc.[1,7,8]

Ultrasonography (US), given its characteristics of non-invasiveness and accessibility, exhibits value in critical conditions such as CA and shock.[9-12] Current guidelines for Advanced Cardiovascular Life Support (ACLS) suggest that US can be an integral part of the resuscitation process.[13] Despite its potential in identifying reversible causes, concerns arise regarding whether US contributes to delays in chest compressions and hence a possible negative impact on patient survival. Previous studies have shown that US prolonged a single pause to 21 seconds, ranging from 13-24 seconds,[14,15] although the pause could be shortened if the US was performed by a well-trained sonographer.[15,16] The benefit contributing to US and the risk of chest compression delays could be balanced.

We conducted a study to investigate the impact of US on CCF and patient survival among patients with out-of-hospital cardiac arrest (OHCA). We also evaluated the individual pause duration and the percentage of prolonged pauses associated with US.

Population Health Research Capsule

What do we already know about this issue?
Whether ultrasonography (US) contributes to the delays in chest compressions and hence a negative impact on survival is uncertain.

What was the research question?
What is the impact of US on chest compression fraction (CCF) and patient survival?

What was the major finding of the study?
The US cardiac arrest group had comparable CCF (93.0% vs 94.3%, P=0.29) with the non-US group. Rates of survival to admission (36% vs. 48%, P=0.13) and to discharge (11% v. 15%, P=0.37) were also similar.

How does this improve population health?
Patients receiving US had comparable CCFs and rates of survival to discharge with a favorable neurological outcome with the non-US group.

MATERIALS AND METHODS

Study Design and Setting

This retrospective study was conducted from April 2017–March 2019 in the emergency department (ED) of National Taiwan University Hospital The protocol was approved by the Institutional Review Board of the hospital's Ethics Committee with a waiver of informed consent, and the study was registered at ClinicalTrials.gov (NCT03695536).

Patients with OHCA were directly transported by emergency medical services to the resuscitation rooms. An organized team was responsible for the resuscitation of the patients at a designated resuscitation area. The resuscitation team was composed of two senior emergency physicians (an attending physician/senior resident as the team leader, with the other for the airway), two junior emergency residents (responsible for chest compressions or defibrillation), and four senior nurses (one for management of airway and ventilation, one for vascular access, one for drug preparation, and one for recordings of the CPR process). All ACLS-certified personnel had pre-allocated roles and tasks.[17] All resuscitation was performed according to the ACLS guidelines.[18]

Overhead video cameras in the resuscitation room had previously been approved to record the CPR process for regular quality review and assurance for more than 10 years. The video recordings were stored in a secured hospital database. Also, a timer was routinely employed during CPR with a regular alarm every two minutes as a reminder to check pulse, and 10 seconds thereafter for resumption of chest compressions. A Noblus US machine (Hitachi Aloka Medical, Ltd, Tokyo, Japan) equipped with 2-5 megahertz curvilinear transducers was kept ready for use in the resuscitation room.

The senior residents who completed basic emergency US training (certified by the Taiwan Society of Emergency Medicine, Supplementary file) and resuscitative US training (the US-Compression Airway Breathing (CAB) training curriculum, Supplementary file)[19] performed sonographic examinations during CPR. All of them had passed the immediate evaluation and the re-evaluation six months later in the simulation settings. They also passed the evaluation in real resuscitation settings and showed their competency in our previous work.[19,20] The cardiac US was routinely performed to detect sonographic cardiac activity after 10 minutes of CPR.[20]

Patient Inclusion

Adult patients >20 years of age (per the Regulations on Human Trials conducted since 2016 in Taiwan) with non-traumatic OHCA were eligible for inclusion. A convenience sample of patients receiving US during resuscitation was included when trained sonographers were available. Patients not receiving US were included in the same month. Exclusion criteria were patients <20 years old, traumatic CA, and do-not-resuscitate (DNR) orders.

Data Collection

The video recordings of resuscitation were downloaded to an encrypted hard drive for retrospective review, and the faces of the resuscitation team members were masked. Each pause, including pause duration and associated activities, was analyzed and recorded by two emergency physicians who were blinded to the study hypothesis, not involved in resuscitation and ultrasound training, and had more than 10 years ED practice. If disagreement occurred, a third member was consulted until consensus was achieved. We recorded the total time spent on chest compressions and in-hospital resuscitation duration from the start of video recording to the end of resuscitation.

The CCF was defined as the fraction of time spent on chest compressions during the in-hospital CPR process. The rate of chest compressions was measured using a timer together with a counter. The percentage of prolonged pauses was defined as the percentage of pause durations of more than 10 seconds.

The clinical information of the patients, including age, gender, past medical history, witness status on CA, bystander CPR, prehospital CPR duration, initial cardiac rhythm, the cause of CA, the doses of epinephrine, and patient survival were obtained from the electronic health records. The cause of CA included cardiovascular (myocardial infarction, pericardial effusion, abdominal aortic aneurysms, dissecting aortic aneurysm, etc); airway (sputum impaction, aspiration, pneumonia, etc); sepsis; and others (malignancy, hyperkalemia, hypotension, hypoglycemia, gastrointestinal bleeding, etc). A favorable neurological outcome was defined as a Glasgow-Pittsburgh Cerebral Performance Category score of 1-2. The emergency physicians who were blinded to the study hypothesis, not involved in resuscitation and ultrasound training, and had more than 10 years of ED experience, reviewed the medical records.

Outcome Measurement

Patients receiving US once or more during resuscitation were categorized as the US group and those not receiving US were categorized as the non-US group. The primary outcome was CCF and the secondary outcomes were the rates of ROSC, survival to hospital admission, and survival to hospital discharge between the two groups. We also assessed the individual pause duration and the percentage of prolonged pauses associated with US.

Sample Size Estimation

We used SAS analytics software version 9.4 (SAS Institute, Inc, Cary, NC) for sample size calculation. We assumed the proportion of patients receiving US during resuscitation was 67.6%.[21] With a power of 0.8 and a 5% significance level, the calculated sample size was 30 patients for each group.

Statistical Analysis

We analyzed all data using SAS . Initially, we used the Shapiro-Wilk test for the normality of continuous data. If the data was not normally distributed, it was expressed in medians and interquartile (IQR) ranges and examined using Wilcoxon's rank-sum test. Categorical data was expressed in counts and proportions and compared using a chi-square test or Fisher's exact test. Intraclass correlation (ICC) with 95% confidence intervals (CI) was used to assess interrater reliability for each pause by two physicians.

To investigate the possible factors associated with the patients receiving US, we further incorporated the factors of statistical significance in univariate analysis in multiple logistic regression analyses. The covariates in the regression model included age, gender, witnessed arrest, bystander CPR, prehospital CPR duration, defibrillation during Basic Life Support (BLS) and ACLS, cardiovascular etiology, doses of epinephrine, and in-hospital resuscitation duration.

Additionally, to investigate the possible factors associated with patient outcomes including ROSC, survival to admission, and survival to discharge, we further incorporated the factors of statistical significance in univariate analysis in multiple regression analysis. The covariates in the regression models included age, gender, witnessed arrest, bystander CPR, prehospital CPR duration, defibrillation during BLS and ACLS, intubation, cardiovascular etiology, doses of epinephrine, and in-hospital resuscitation duration, and the use of US. We computed odds ratios (OR) with 95% CIs.

Since there were numerous pauses on each patient during resuscitation, a within-subject correlation on pause length would exist. We applied repeated measures using a mixed model to compare the pause durations associated with US in the US group. Covariates in the mixed models included group (with or without US), and the number of times associated with certain activities. A *P*-value of less than 0.05 was considered statistically significant.

RESULTS

Characteristics of Study Subjects

We collected data on 320 adult patients with OHCA from April 2017–March 2019. After excluding the patients with trauma and DNR orders, we included 236 patients in the current analysis (Figure). Ninety-two patients (39%) achieved ROSC, 90 patients (38%) survived to admission, 27 (11%) survived to discharge (Figure) and 13 (6%) survived with favorable neurological outcomes. A total of 190 patients received US once or more during resuscitation.

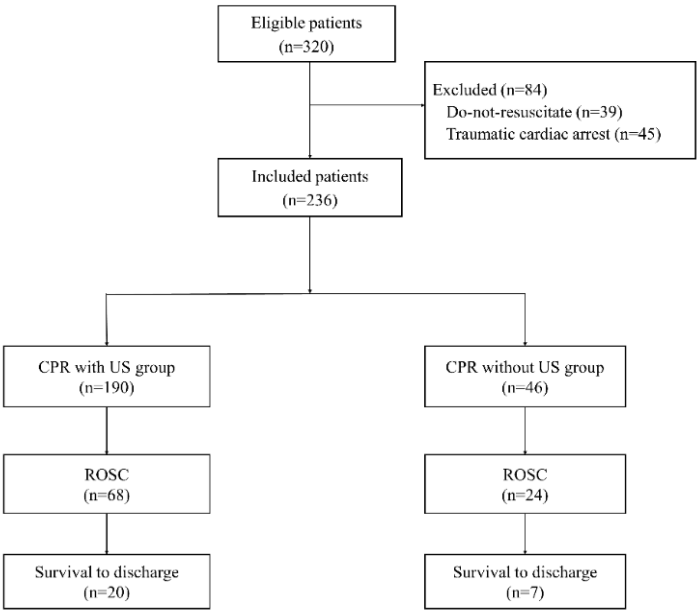

Figure. The study diagram.
CPR, cardiopulmonary resuscitation; *ROSC,* return of spontaneous circulation; *US,* ultrasonography.

Table 1. Characteristics of the included patients.

Characteristics	Total (N=236)	US group[e] (n=190)	Non-US group (n=46)	P-value
Age, years[a]	69 (60.5, 82)	69 (60, 82)	70 (63, 84)	0.64
Male, n (%)	144 (61%)	118 (62%)	26 (57%)	0.49
Medical history, n (%)				
Diabetes mellitus	66 (28%)	57 (30%)	9 (20%)	0.16
Hypertension	127 (54%)	105 (55%)	22 (48%)	0.36
Cardiac disease[b]	90 (38%)	72 (38%)	18 (39%)	0.88
Pulmonary disease[b]	17 (7%)	13 (7%)	4 (8%)	0.66
Renal disease[b]	45 (19%)	34 (18%)	9 (20%)	0.79
Malignancy	42 (18%)	32 (17%)	10 (22%)	0.44
Etiology of arrests, n (%)				
Cardiovascular[c]	114 (48%)	101 (53%)	13 (28%)	<.001
Airway	47 (20%)	36 (19%)	11 (24%)	0.45
Sepsis	20 (8%)	16 (8%)	4 (9%)	0.95
Other[d]	55 (23%)	37 (19%)	18 (39%)	<.001

[a]Expressed as median (interquartile ranges).
[b]Cardiac disease included coronary artery disease, heart failure, and arrhythmia; pulmonary disease included bronchial asthma and chronic obstructive pulmonary disease; renal disease included chronic renal insufficiency, and end-stage renal disease receiving dialysis.
[c]There were 5 patients with myocardial infarction, 5 with dissecting aortic aneurysms, 5 with pericardial effusion, and 2 ruptured abdominal aortic aneurysms in the CPR with US group. Four patients had a myocardial infarction in the CPR without US group.
[d]There were 10 patients with malignancy, 7 with hyperkalemia, 6 with hypotension, and 14 with unknown causes in the CPR with US group. Seven patients with hypotension, 6 patients with malignancy, 2 with hypoglycemia, 2 with intracranial hemorrhage, and 1 with gastrointestinal bleeding in the CPR without US group.
[e]Sonographic cardiac activity was detected in 85 patients receiving US. Those with sonographic cardiac activity exhibited a higher chance of the return of spontaneous circulation (64/68 vs 21/122, P<0.0001).
[f]Comparisons between the two groups.
CPR, cardiopulmonary resuscitation; *US,* ultrasonography.

There was good interrater reliability in the pause duration with an ICC of 0.92 (95% CI 0.85-0.96) and the associated activities with an ICC of 0.86 (95% CI 0.80-0.95).

After the examination of normality, age, prehospital CPR duration, in-hospital resuscitation duration, in-hospital pauses, the dose of epinephrine, chest compression rate, and CCF (all $P<0.0001$) were not normally distributed and presented with medians and IQRs. See Table 1 for patient demographics. No significant differences were noted in age, gender, and underlying medical diseases between the two groups. The median timing of US was at the eighth minute of CPR (IQR, 6^{th}-12^{th} minute).

A greater percentage of the arrests was attributed to cardiovascular etiology in patients receiving US (53% vs 28%, $P<.001$). Among them, dissecting aortic aneurysms, massive pericardial effusion, and ruptured abdominal aortic aneurysms were diagnosed in 12 patients with the aid of US. One patient with dissecting aortic aneurysm was sent to the operating room following ROSC, and five with pericardial effusion received pericardiocentesis. Also, sonographic cardiac activity was detected in 85 patients receiving US. Of 68 patients achieving ROSC, 64 had sonographic cardiac activity. Patients with sonographic cardiac activity exhibited a higher chance of ROSC (64/68 vs 21/122, $P<0.001$).

Chest Compression Fraction

Ultrasound was not associated with a lower CCF, although longer in-hospital resuscitation duration was observed in the US group (Table 2). There was no significant difference in witnessed arrest, bystander CPR, prehospital CPR duration, initial shockable rhythm, defibrillation, intubation, the dose of epinephrine, and chest compression rate between the two groups.

The univariate regression analysis showed that cardiovascular etiology (OR 2.78, 95% CI 1.06-7.28) and longer resuscitation duration (OR 1.08, 95% CI 1.03-1.13) were associated with the use of US. Longer resuscitation duration (OR 1.08, 95% CI 1.03-1.13) remained significant

Table 2. The cardiac arrest event and resuscitation characteristics.

Characteristics	Total (N=236)	US group (n=190)	Non-US group (n=46)	P-value[d]
Witnessed arrest, n (%)	162 (69%)	129 (68%)	33 (72%)	0.61
Bystander CPR, n (%)	131 (56%)	103 (54%)	28 (61%)	0.41
Pre-hospital CPR duration, minutes[a]	16.0 (5.0, 23.0)	18.0 (5.0, 23.0)	5.0 (4.0, 20.0)	0.18
Initial shockable rhythm, n (%)	24 (10%)	24 (13%)	0	0.06
Defibrillation during BLS and ACLS, n (%)	62 (26%)	55 (29%)	7 (15%)	0.06
In-hospital endotracheal intubation, n (%)[b]	166 (70%)	139 (73%)	27 (59%)	0.06
Epinephrine, mg[a]	8 (6, 12)	8 (6, 12)	7 (3, 12.5)	0.24
Chest compression rate, /minutes[a]	106.5 (101, 112)	108 (101, 112)	105 (101, 108)	0.52
In-hospital resuscitation duration, min[a]	27.7 (11.9, 32.0)	30.3 (13.6, 32.5)	9.7 (7.1, 24.5)	<.001
In-hospital pauses, n[a,c]	15 (9, 18.5)	15 (11, 20)	9 (5, 13)	<0.001
In-hospital pause duration, minutes[a]	1.4 (0.9, 2.2)	1.6 (1.0, 2.3)	0.8 (0.4, 1.4)	<0.001
In-hospital chest compression fraction, %[a]	93.5 (90.8, 95.0)	93.0 (91.2, 94.9)	94.3 (89.8, 96.3)	0.29

[a]Expressed as median (interquartile ranges).
[b]In the ultrasound group, 103 patients received one attempt of intubation, 32 received 2 attempts and 4 received 3 attempts. In the non-US group, 26 patients received one attempt, and 1 received 2 attempts.
[c]Indicated the number of pauses during in-hospital resuscitation.
[d]Comparisons between the two groups.
BLS, Basic Life Support; *ACLS,* Advanced Life Support; *CPR,* cardiopulmonary resuscitation; *US,* ultrasonography.

after adjusting cardiovascular etiology in the multiple regression analysis (Table 3).

Patient Outcomes

Although patients not receiving US had a better rate of ROSC (36% vs 52%, *P*=0.04), the rates of survival to admission (36% vs 48%, *P*=0.13), survival to discharge (11% vs 15%, *P*=0.37), and survival with favorable neurological outcome (5% vs 9%, *P*=0.23) did not differ between the two groups (Table 4). The significant factors associated with patient survival are shown in Supplementary Table 1. Longer in-hospital resuscitation duration was associated with less chance of ROSC, survival to admission, and survival to discharge after adjusting other parameters.

Table 3. Variables for patients receiving ultrasonography during resuscitation.

Variables	Univariate regression Odds ratio (95% CI)	Multiple regression Odds ratio (95% CI)
Age	1.00 (0.98-1.03)	
Gender	1.17 (0.48-2.89)	
Witnessed arrest	0.71 (0.26-1.95)	
Bystander CPR	0.72 (0.29-1.78)	
Pre-hospital CPR duration	1.04 (0.99-1.09)	
Defibrillation during BLS and ACLS	2.06 (0.65-6.52)	
Doses of epinephrine	1.04 (0.95-1.13)	
Cardiac etiology	2.78 (1.06-7.28)[a]	2.02 (0.73-5.58)
In-hospital resuscitation duration	1.08 (1.03-1.13)[b]	1.08 (1.03-1.13)[c]

[a]P=0.04. [b]P=0.02. [c]P=0.02.
CPR, cardiopulmonary resuscitation; *ED,* emergency department, *CI,* confidence interval.

Table 4. Resuscitation outcomes.

Characteristics	Total (N=236)	US group (n=190)	Non-US group (n=46)	P-value[a]
Return of spontaneous circulation, n (%)	92 (39%)	68 (36%)	24 (52%)	0.04
Survival to hospital admission, n (%)	90 (38%)	68 (36%)	22 (48%)	0.13
Survival to hospital discharge, n (%)	27 (11%)	20 (11%)	7 (15%)	0.37
Survival with favorable neurological outcome, n (%)	13 (6%)	9 (5%)	4 (9%)	0.23

[a]Comparison between the two groups.
US, ultrasonography.

Pause Duration and the Percentage of Prolonged Pauses Associated with Ultrasound

There were 3,386 pauses analyzed in this study. The details of activities during pauses are listed in Supplementary Table 2. Pulse checks were the most common activities. and all US was performed during pulse checks.

In the US group, US was performed in 284 (15%) of the 1,835 pulse checks. A mixed model was applied to clarify intra-patient correlation and time-dependent effects. Covariates included the use of US and the number of times for pulse checks. Among patients receiving US, the pause duration of pulse checks with US was longer than pulse checks alone (median, 8 vs 6 seconds, *P*=0.02, Table 5). No time-varying effect was identified (*P*=0.16). No difference existed in the pause duration of pulse checks alone between the two groups (*P*=0.21).

Table 5. Pause duration for pulse checks and the percentage of prolonged pauses.

	US group (190 patients)		Non-US group (46 patients)
	Pulse checks plus US (N=284)	Pulse checks alone (n=1,551)	Pulse checks alone (n=234)
Pause duration, seconds[a]	8 (6, 10)[b]	6 (5, 8)[b]	7 (5, 8)
Prolonged pause, n (%)	45 (16%)[c,d]	211 (14%)[c]	32 (14%)[d]

[a]Expressed as median (interquartile ranges). [b]P=0.02, compared with the pause for pulse checks with and without US. [c]P=0.32. [d]P=0.49.
US, ultrasonography.

The percentage of prolonged pauses was similar between the pulse checks alone and those with US (14% vs 16%, *P*=0.316) among patients receiving US. The percentage of prolonged pauses was also similar compared to those during pulse checks with US in the US group with those during pulse checks alone in the non-US group (16% vs 14%, *P*=0.49).

Notably, all the US was performed not only during the pause for pulse checks but extended into the next chest compression phase. The sonographic examination was focused on the heart during the pulse checks (Supplementary Table 3). Once chest compression was resumed, the sonographer either continued US scanning of the heart or switched to screen other targets such as the abdominal aorta or to scan for any existence of intraperitoneal free fluid.

DISCUSSION

In recent decades, US has become a frequently used imaging tool during resuscitation. Many resuscitative US protocols such as the Cardiac Arrest Ultrasound Exam,[22] Focused Echocardiographic Evaluation in Life Support (FEEL),[23] the Sequential Echographic Scanning Assessing Mechanism protocol,[24] Cardiac Arrest Sonographic Assessment (CASA) protocol,[16] US-CAB,[20] and Sonography in Hypotension and Cardiac Arrest (SHoC)[25] were developed to search for potentially reversible causes of CA. Ultrasonography has been reported to prolong the duration of pause and delay the resumption of chest compressions.[14,15] However, the evidence regarding US on overall CCF was limited. In this study, patients receiving US had CCF comparable with those who did not receive US. Although patients without US had a better rate of ROSC, the rates of survival to admission, survival to discharge, and survival with a favorable neurological outcome did not differ between the two groups. Ultrasonography was related to lengthening individual pause duration; however, the percentage of prolonged pauses was similar between the two groups.

Avoiding unnecessary interruptions of chest compressions and reducing pause duration have been repeatedly emphasized in this era of high quality CPR. In recent years, an even more important indicator, CCF, has been identified as a key benchmark of the quality of CPR.[26] Previous studies have shown that increased CCF results in a higher rate of ROSC,[6] although a ceiling effect exists once the CCF is greater than 80%.[5,27] To date, the studies regarding US during CPR mostly reported the individual pause duration but not the CCF during the whole resuscitation process.[14,15] Although the individual pause could be lengthened with the employment of US,[14,15] the overall impact on CCF is not clear yet. This study showed the CCF in patients receiving US was similar to those without, possibly because US was performed in about 15% of pulse checks. Although the individual pause was prolonged with US, the overall CCF was not influenced.

The overall CCF was as high as 93% in this study, which was higher than the recommendation.[28] Such a high CCF could be explained by adequate manpower, structured ACLS teamwork, and the employment of a timer reminding the resumption of chest compressions. In the current study, at least eight members were involved in each resuscitation scenario. The work of each member was pre-assigned and well-orchestrated. Also, the timer played a key role in reminding the team members to keep the pause as short as possible, even when US was being performed. Without such reminders, the leader and the sonographer would tend to concentrate on their work at hand and overlook the elapsed time. Moreover, proper US training and a readily available US machine are important. All the sonographers in this study completed the basic US and resuscitative US training beforehand. Through continued practice and accumulation of experience, the sonographers exhibited excellent US performance,[19] even during CPR.

Moreover, a high quality portable US machine properly equipped and located in a resuscitation room is essential. This helps speed up imaging acquisition and interpretation.

Further, US was performed not only during the pause period but extended to the next cycle of chest compressions. In previous studies, the US was performed during the pause for pulse checks only. If the sonographer tried to finish or extend the US exploration, the pause duration could be prolonged. On the contrary, if the sonographer allowed the resumption of chest compressions while continuing US examination in the following cycle,[29] the pause duration could become shorter. Allowing resumption of compressions while continuing US largely broadened the time window for US assessment during CPR. Although US examination during the chest compression phase is much more challenging, the sonographer could take the chance of trying to complete the views that were not finished during the pause period. If chest compressions made the subxiphoid view of the heart not feasible, the sonographer could switch to other views checking the abdomen, chest, or other sites. In the current study, the aorta and any presence of intraperitoneal free fluid were the most often checked targets during the chest compression phase, while the subxiphoid view of the heart was mostly done during the pause period. Altogether the factors above would help make CCF highly compliant with the ACLS guidelines and shorten pause duration related to US, compared to the results reported in previous studies.[14,15]

In this study, we also focused on the effect of US on patient-centered outcomes. Although patients receiving US had a lower rate of ROSC, the effect of US was not significant for patient outcomes in the regression analysis. Witness arrest was positively associated with ROSC; by contrast, in-hospital resuscitation duration had a negative association with ROSC, survival to admission, and survival to discharge. It is noteworthy that our results showed that longer resuscitation duration was associated with the use of US. A similar phenomenon was reported in the previous research.[30] This was reasonable since the longer the resuscitation without achieving ROSC, the more likely US would be employed during CPR searching for potentially reversible causes. On the other hand, it implies that the employment of US started after the standard resuscitation efforts or equipment had already been applied. With the retrospective nature of this study and convenience sampling, any conclusion that the use of US either improved or diminished the effectiveness of CPR could not be drawn. Further randomized studies would be needed to answer the question.

Although the pause duration during pulse checks with US was still longer than pulse checks alone in our study, the median duration was less than 10 seconds. The results were concordant with those in the FEEL study.[9] By contrast, the PUCA study of paramedic-led echo in life support showed a pause duration of 17 seconds with US in prehospital settings.[31] Previous studies showed that US prolonged a single pause to 21 seconds.[14,15] However, as shown in the CASA study, this could be shortened by the implementation of the US protocol and the presence of US-trained faculty.[16]

Given that sonographic cardiac activity could be a prognostic factor for ROSC, the possible etiology of arrests could be identified or ruled out with the use of US. In patients receiving US, dissecting aortic aneurysms, massive pericardial effusion, and ruptured abdominal aortic aneurysms were detected in 12 patients and ruled out in the 178 remaining patients. However, mortality resulting from aortic dissection or rupture remained very high in arrest patients.[32] Another important observation was that the chance of identifying reversible causes by US during CPR (such as cardiac tamponade, pulmonary thromboembolism, hypovolemia, acute coronary syndrome, et.) was generally low, making the chance of dramatic improvement by specific interventions much lower.

LIMITATIONS

There were limitations in this study. First, the data was collected from a convenience sample and retrospective reviews. Missing data or abstractor bias could have occurred.[33] There is a significant likelihood of selection bias, particularly regarding the imbalance in causes of CA between the groups. However, the results showed longer resuscitation duration was the only significant factor associated with the use of US after adjusting the confounders in the multivariate regression model. It implied the physician used US in a higher percentage of patients with sustained arrest to search for potentially reversible etiology after standard resuscitation efforts, reflecting the real scenario. Also, the faces of the resuscitation team members were masked and blinded to the researchers. The interrater reliability was fair. The chart abstractors were blinded to the study hypothesis. Nevertheless, a nonprobability sample would limit the interpretation of the findings. Further randomized trials would be needed to prevent certain bias.

Second, the study was conducted in a single center with well-structured ACLS teamwork and active US training. Notably, a timer was used in the resuscitation scenarios, reminding the physicians to avoid prolonged pauses. While as a whole the resources, assignments, and training of the clinicians demonstrated a high CCF, any extrapolation of the results would be uncertain. However, we provided a possible solution to lessen or avoid interruptions of CPR with the use of US. Future studies would be needed to test whether these results could be extrapolated to other settings.

Third, there were cameras in the resuscitation room. This would have introduced selection bias if patients received resuscitation outside that room. In this study, all the patients were resuscitated in the resuscitation room. There was the possibility of the Hawthorne effect due to the presence of cameras, although they had been in place for more than 10 years for quality control of CPR in our department. Fourth, the chest compression depth was not measured for CPR quality and could not be adequately interpreted using video review in the current study. This could be improved by incorporating optical sensors or other methods in future studies.[34,35]

Finally, the findings of US during CPR, and hence the decision on resuscitation measures and impact on patient outcomes, could not be easily clarified. Theoretically, this is the most valuable part that US may play during CPR. However, the number of meaningful positive US findings that led to critical therapeutic interventions was small.

CONCLUSION

Patients receiving ultrasound during resuscitation had comparable chest compression fractions and rates of survival to admission and discharge, and survival to discharge with a favorable neurological outcome when compared to those without US. The individual pause was lengthened related to US. However, patients without US had a shorter resuscitation duration and a better rate of return of spontaneous circulation. The trend toward poorer results in the US group was possibly due to confounding variables or convenience sampling and should be studied in future randomized studies.

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Prevalence and Risk Factors of Insomnia and Sleep-aid Use in Emergency Physicians in Japan: Secondary Analysis of a Nationwide Survey

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Introduction: Emergency physicians (EP) are suspected to have a high prevalence of insomnia and sleep-aid use. Most prior studies about sleep-aid use in EPs have been limited by low response rates. In this study our aim was to investigate the prevalence of insomnia and sleep-aid use among early-career Japanese EPs and assess the factors associated with insomnia and sleep-aid use.

Methods: We collected anonymous, voluntary, survey-based data regarding chronic insomnia and sleep-aid use from board-eligible EPs taking the initial Japanese Association of Acute Medicine board certification exam in 2019 and 2020. We describe the prevalence of insomnia and sleep-aid use and analyzed demographic and job-related factors using multivariable logistic regression analysis.

Results: The response rate was 89.71% (732 of 816). The prevalence of chronic insomnia and sleep-aid use was 24.89% (95% CI 21.78-28.29%) and 23.77% (95% CI 20.69-27.15%), respectively. Factors associated with chronic insomnia were long working hours (odds ratio [OR] 1.02, 1.01-1.03, per one-hour/week), and "stress factor" (OR 1.46, 1.13-1.90). Factors associated with sleep-aid use were male gender (OR 1.71, 1.03-2.86), unmarried status (OR 2.38, 1.39-4.10), and "stress factor" (OR 1.48, 1.13-1.94). The "stress factor" was mostly influenced by stressors in dealing with patients/families and co-workers, concern about medical malpractice, and fatigue.

Conclusions: Early-career EPs in Japan have a high prevalence of chronic insomnia and sleep-aid use. Long working hours and stress were associated with chronic insomnia, while male gender, unmarried status, and stress were associated with the use of sleep aids. [West J Emerg Med. 2023;24(2)331–339.]

INTRODUCTION

Emergency physicians' (EP) sleep cycles and wellness are challenged by their irregular shift work.[1] Night shifts are associated with sleep difficulty, shorter sleep time, low levels of alertness, and less optimal performance by emergency medicine (EM) residents and attendings.[2] Driving after night shifts is related to a high risk of motor vehicle collisions and near-crashes for EM residents.[3] Shift work in general is also associated with increased risk of stroke and coronary heart disease.[4,5] Sleep disturbance is linked to burnout,[6] and an American College of Emergency Physicians Policy Resource and Education Paper reported that the adverse effect of rotating shifts is the most important reason for early attrition from EM.[7]

Despite these detrimental effects, night shifts will always be a part of the EP's work routine in order to provide the necessary care for patients and maintain the essential functions of hospitals. Due to shift work and the resulting sleep disturbance. insomnia and sleep-aid use appear to be prevalent among EPs.[8-12] In fact, some North American studies report that as many as 56% of EPs use a sleep aid.[13] However, most of the data about insomnia and sleep-aid use in EPs is based on surveys limited by low response rates.[8-10] The prevalence of insomnia and sleep-aid use is not known among Japanese EPs but is presumed to be higher than the reported national Japanese average of 12.2-21.5%.[14,15] Nevertheless, these reported numbers are alarmingly high, especially when considered in relation to the possible harmful effects of sleep-aid use, such as impaired sleep quality, daytime somnolence, and psychomotor impairment.[16] In addition, factors associated with insomnia and sleep-aid use have not been well studied.

In this study our goal was to describe the prevalence of insomnia and sleep-aid use among early-career EPs in Japan, as well as identify the factors associated with chronic insomnia and sleep-aid use. Understanding the factors associated with insomnia and sleep-aid use may contribute to changes in the way EPs work to reduce the need for the use of sleep aids for insomnia, as well as a heightened awareness of this problem in those who are innately high risk.

Population Health Research Capsule

What do we already know about this issue?
Shift work is an unavoidable element of emergency medicine, Insomnia and sleep-aid use are reported to be common among emergency physicians (EP).

What was the research question?
We aimed to describe the prevalence and cause of their insomnia and sleep-aid use based on a survey of Japanese EPs who took the board certification exam in 2019 and 2020.

What was the major finding of the study?
The prevalence of chronic insomnia and sleep-aid use were 24.89% and 23.77%, respectively. Stress and long working hours were associated factors.

How does this improve population health?
Improvements in work style and alleviation of stress may positively affect the well-being of EPs.

METHODS

Study Design and Population

This study is a secondary analysis of the survey-based career satisfaction data collected in 2019 and 2020 from board-eligible EPs taking the Japanese Association for Acute Medicine (JAAM) initial board certification exam. To become board-eligible in EM in Japan, physicians must complete a two-year general, combined medical-surgical transitional training program, in addition to at least three years of EM training at an accredited residency program. Emergency medicine residents in Japan spend most of their time in the emergency department (ED) to experience a predetermined number of procedures and cases, but there are no specific rules regarding how many months they need to spend in the ED or the sequence of these rotations. They also spend a fair number of rotations in the intensive care unit (ICU). Upon graduating residency, EPs in Japan often work in both the ED and ICU. The majority of physicians practicing in the ICU are also board-certified in EM,[17] and the majority of those who are not board-certified in critical care are EPs.[18] The details of creating the career-satisfaction survey and survey results were published in 2021.[19] Printed questionnaires were distributed to the exam participants and were completed at the site anonymously and voluntarily. The questionnaire included questions about the following domains: demographics (age, gender, postgraduate year, marital status, presence of children in their life); work environment; insomnia, burnout, and use of sleep aids; professional satisfaction; and concerns and stressors. All questions were multiple choice (Table 1).

Data Analysis

The current study focuses on insomnia and sleep-aid use. With regard to insomnia, the participants selected an answer from four choices: had never experienced insomnia; had a brief episode of insomnia; had an experience of chronic insomnia; or currently suffered from chronic insomnia. For statistical analysis, we considered the prevalence of insomnia in our population to include those respondents whose

Table 1. The survey items.

Basic information					
(1) What is your gender?	○ Male	○ Female			
(2) What is your age?					
(3) Postgraduate year	○ PGY6	○ PGY7	○ PGY8	○ PGY9	○ PGY>10
(4) Are you married?	○ Married	○ Unmarried			
(5) Do you have a child (children)?	○ Yes	○ No			
(6) Choose your type of practice	○ ED only	○ ED combined with inpatient ward, ICU, and/or OR			
(7) Choose your type of night shift.					
A: Night shifts are always connected with day shifts. (Works longer than 24 hours to cover nights.)					
B: Night shifts are separated from day shifts.					
C: Mixture of A and B					
(8) Number of night shifts per month	○ 1-3	○ 4-5	○ 6-7	○ 8-9	○ ≥10
(9) Working hours per week	○ ≤40	○ 40-59	○ 60-79	○ 80-100	○ ≥101
(10) Monthly salary (unit: 10000 yen)	○ ≤30	○ 31-50	○ 51-70	○ 71-100	○ ≥101
(11) Number of ambulance transfers per year					
○ ≤2000	○ 2001-4000	○ 4001-6000	○ 6001-8000	○ 8001-10000	○ ≥10001
(12) Number of attending emergency physicians (board-certified) at your facility					
○≤2	○3-6	○≥7			
Insomnia and Burnout					
(1) What is your experience of insomnia?					
○ Never experienced insomnia	○ Had a brief episode of insomnia				
○ Had an experience of chronic insomnia	○ Currently suffer from chronic insomnia				
(2) Which substance have you used as sleep-aid?					
○ Never used sleep-aid	○Alcohol	○ Antihistamine	○ Benzodiazepine		
○ Herbal supplement	○ Analgesic	○ Others			
(3) What is your experience of burnout					
○ No symptoms of burnout	○ Occasionally I am under stress, but I don't feel burned out.				
○ Definitely burning out and have symptoms of burnout, such as physical and emotional exhaustion					
○ The symptoms of burnout that I'm experiencing won't go away.					
○ Completely burned out and often wonder if I can go on.					
Professional Satisfaction (5-point Likert scale: 1, very dissatisfied; 5, very satisfied)					
Personal					
(1) How satisfied are you with your income?					
(2) How satisfied are you with your private time?					
(3) How satisfied are you with your knowledge in emergency medicine?					
(4) How satisfied are you with your development of skills and knowledge through practice?					
(5) How satisfied are you with the opportunity to participate in conference?					
(6) How satisfied are you with your time reading medical literature to learn new knowledge?					
Residency Program					
(7) How satisfied are you with how organized your residency training was?					
(8) How satisfied are you with the number of supervising attending physicians during training?					
(9) How satisfied are you with the bedside education you received from attending physicians?					
(10)Overall, how satisfied are you with your emergency medicine residency training?					
Current Facility					
(11) How satisfied are you with the access to clinical resources for problem solving?					

ED, emergency department; *ICU,* intensive care unit; *OR,* operating room; *PGY,* postgraduate year.

Table 1. Continued.

Professional Satisfaction (5-point Likert scale: 1, very dissatisfied; 5, very satisfied)
(12) How satisfied are you with the availability of teaching opportunities in your current position?
(13) How satisfied are you with the availability of research opportunities in your current position?
(14) How satisfied are you with the emergency department management by administrators?
(15) How satisfied are you with the patient volume?
(16) How satisfied are you with working hours?
Overall satisfaction
(17) How satisfied are you with your emergency medicine career?
Concerns and Stressors (5-point Likert scale: 1, low; 5, high)
(1) How concerned are you about medical malpractice?
(2) How stressed are you from issues associated with patients and their families?
(3) How stressed are you from issues associated with your colleague, including nurses, pharmacists, radiology technicians, and administrators?
(4) How fatigued are you?
Career Satisfaction (Yes/No)
(1) Do you have a mentor(s)?
(2) If you were to go back to a time before emergency medicine residency, would you still choose emergency medicine again as your specialty?
(3) Would you switch your specialty?

ED, emergency department; *ICU,* intensive care unit; *OR,* operating room; *PGY,* postgraduate year.

answer was either "had an experience of chronic insomnia" or "currently suffered from chronic insomnia." No specific definition was included to delineate chronic from brief insomnia. As for sleep-aid use, we asked the respondents to select all the sleep aids they had used (if any) from six different categories: alcohol; antihistamine; benzodiazepine; herbal supplement; analgesic; and other. Given that melatonin is not available as an over-the-counter medication in Japan, it was not included as a separate choice. Questions about the time and frequency of sleep-aid use were not asked.

Regarding Likert-type response items, we first conducted factor analysis. Factor analysis was performed to identify a small number of more meaningful latent factors behind many variables in an attempt to explain the data using this small number of factors. In factor analysis, we included 16 questions that asked about professional satisfaction as well as four questions about concerns and stressors—all graded on a five-point Likert scale. We reviewed floor effects and ceiling effects for each question before conducting factor analysis. The number of factors extracted was decided based on the scree plot of eigenvalues and the previous study.[19]

In the factor analysis, we used maximum likelihood with the expectation-maximization algorithm to estimate the covariance matrix for missing data.[20,21] We then performed multivariable logistic regression analysis with factor scores obtained through the factor analysis and other demographic and work environment data including gender, age, marital status, postgraduate year (PGY), working hours per week, presence of children in the home, long shifts (longer than 24-hour shift to cover nights), number of night shifts per month, annual number of ambulances arriving at the facility, and number of attending EPs at the facility. Postgraduate year was viewed as a dichotomous value: 5 to 7, or ≥8. Before we performed the multivariable logistic regression analysis, missing data was imputed 20 times with multiple imputation by chained equation, and the results were combined applying Rubin's rule. We performed statistical analysis with complete dataset for sensitivity analysis. We used Stata16 (StataCorp LLC, College Station, TX) for statistical analysis. A *P*-value less than 0.05 was considered statistically significant.

Ethical Consideration

All data was collected anonymously, and this survey was approved by the JAAM Ethics Committee. (JAAM20180808)

RESULTS

The questionnaire was handed out to 433 and 383 board-eligible EPs at the board exam in 2019 and 2020, respectively. Response rates were 93.07% in 2019 (403 of 433) and 85.90% in 2020 (329 of 383), and the overall response rate was 89.71% (732 of 816). The majority of respondents were in their thirties (77.15%), with a median of PGY-7 (6.0-10.0). One-third of the participants were PGY-10 or greater (269 of 732). Of 679 respondents, 169 (24.89%, 95% confidence interval [CI] 21.78%-28.29%) reported that they experienced chronic insomnia, while 159 of 669 respondents reported a history of sleep-aid use (23.77%, 95% CI 20.69%-27.15 %) (Table 2). Sixty-one

Table 2. Participants' characteristics.

		Total	Chronic insomnia (-)	Chronic insomnia (+)	P-value	Total	Sleep-aid (-)	Sleep-aid (+)	P-value
		N=679	N=510	N=169		N=669	N=510	N=159	
Male gender		540 (79.5%)	410 (80.4%)	130 (76.9%)	0.32	531 (79.6%)	400 (78.7%)	131 (82.4%)	0.37
Age	20-29	30 (4.5%)	25 (5.0%)	5 (3.0%)	0.08	30 (4.5%)	26 (5.2%)	4 (2.5%)	0.58
	30-39	520 (77.5%)	399 (79.0%)	121 (72.9%)		509 (76.9%)	388 (77.0%)	121 (76.6%)	
	40-49	103 (15.4%)	68 (13.5%)	35 (21.1%)		104 (15.7%)	75 (14.9%)	29 (18.4%)	
	50-59	10 (1.5%)	6 (1.2%)	4 (2.4%)		11 (1.7%)	9 (1.8%)	2 (1.3%)	
	≥60	8 (1.2%)	7 (1.4%)	1 (0.6%)		8 (1.2%)	6 (1.2%)	2 (1.3%)	
Post-graduate year	6-7	351 (52.2%)	277 (54.9%)	74 (44.0%)	0.02	346 (52.2%)	270 (53.4%)	76 (48.4%)	0.31
	≥8	322 (47.8%)	228 (45.1%)	94 (56.0%)		317 (47.8%)	236 (46.6%)	81 (51.6%)	
Unmarried		209 (30.8%)	159 (31.2%)	50 (29.6%)	0.70	211 (31.6%)	141 (27.7%)	70 (44.0%)	<0.01
With child		332 (50.1%)	249 (50.0%)	83 (50.3%)	1.00	325 (49.7%)	261 (51.8%)	64 (42.7%)	0.05
Shift length ≥ 24 hours		208 (31.0%)	148 (29.3%)	60 (36.4%)	0.10	203 (30.7%)	144 (28.5%)	59 (37.8%)	0.03
Working hours per week	40	28 (4.2%)	23 (4.6%)	5 (3.0%)	<0.01	26 (4.0%)	18 (3.6%)	8 (5.1%)	0.64
	41-60	261 (39.2%)	212 (42.2%)	49 (29.9%)		254 (38.7%)	196 (39.4%)	58 (36.7%)	
	61-80	240 (36.0%)	180 (35.9%)	60 (36.6%)		239 (36.4%)	179 (35.9%)	60 (38.0%)	
	81-100	94 (14.1%)	66 (13.1%)	28 (17.1%)		93 (14.2%)	74 (14.9%)	19 (12.0%)	
	≥101	43 (6.5%)	21 (4.2%)	22 (13.4%)		44 (6.7%)	31 (6.2%)	13 (8.2%)	
Night shifts per month	1-3	104 (15.7%)	74 (14.9%)	30 (18.1%)	0.03	100 (15.2%)	79 (15.8%)	21 (13.5%)	0.37
	4-5	234 (35.2%)	177 (35.5%)	57 (34.3%)		231 (35.2%)	172 (34.4%)	59 (37.8%)	
	6-7	204 (30.7%)	166 (33.3%)	38 (22.9%)		202 (30.8%)	148 (29.6%)	54 (34.6%)	
	8-9	83 (12.5%)	56 (11.2%)	27 (16.3%)		84 (12.8%)	70 (14.0%)	14 (9.0%)	
	≥10	39 (5.9%)	25 (5.0%)	14 (8.4%)		39 (5.9%)	31 (6.2%)	8 (5.1%)	

participants reported both chronic insomnia and a history of sleep-aid use. Alcohol was the most common sleep-aid; 91 reported the use of alcohol (13.62%, 95% CI 11.22%-16.44%). Benzodiazepine was the second most reported sleep-aid (Figure 1).

We performed factor analysis after confirming there were no floor effects or ceiling effects. We extracted four factors with maximum likelihood method and subsequently performed Promax rotation. A professional satisfaction question regarding patient volume at current facility did not show sufficient factor loading; therefore, it was removed from further analysis. We performed factor analysis again with maximum likelihood method and Promax rotation with the expectation-maximization algorithm for missing data. These extracted factors were inductively categorized as the following: "educational/clinical system factor"; "work condition factor"; "skill/knowledge development factor"; and "stress factor," all of which were based on items that had high factor loading for each factor (Table 3).

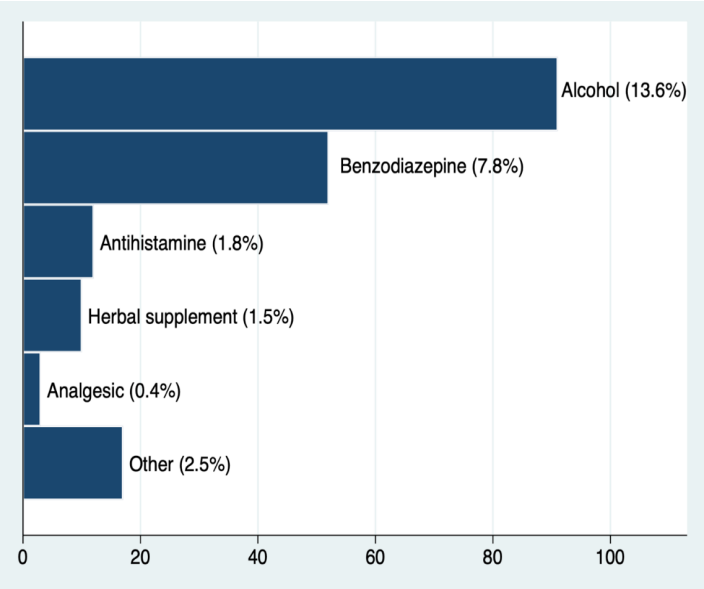

Figure 1. Sleep-aid use pattern.

Table 3. Factor loading of questionnaire items for inductively categorized factors (pattern matrix after Promax rotation).

	"Educational and clinical system factor"	"Work condition factor"	"Skill and knowledge development factor"	"Stress factor"
Satisfaction with bedside education received	0.8807	-0.074	-0.1102	0.0013
Satisfaction with clinical resources for problem solving	0.8633	-0.071	-0.0761	-0.0749
Satisfaction with number of supervising attending physicians during training	0.7637	0.0843	-0.1548	0.0918
Satisfaction with residency organization	0.7102	-0.0138	-0.0038	0.0033
Satisfaction with teaching opportunities in current position	0.6533	0.0991	-0.0058	0.0253
Satisfaction with administration	0.6394	0.1637	-0.0768	0.0426
Satisfaction with research opportunities in current position	0.5435	-0.0587	0.0816	-0.0705
Satisfaction with residency training overall	0.5252	0.1576	0.0775	0.0112
Opportunity for participation in conference	0.4058	-0.1114	0.3152	-0.0406
Satisfaction with personal time	-0.0719	0.8036	0.0835	0.0308
Satisfaction with working hours	0.1503	0.7309	-0.0221	0.1024
Satisfaction with income	-0.0295	0.5162	0.1485	0.1124
Satisfaction with knowing enough	-0.2279	0.0835	0.9349	0.0303
Satisfaction with skill development	-0.0411	0.0209	0.7293	-0.0082
Satisfaction with keeping up with literature	0.252	-0.1448	0.4111	-0.0455
Stress with patients/families	-0.0152	0.0976	0.0273	0.8781
Concern about medical malpractice	0.0356	0.0439	-0.0201	0.7407
Stress with co-workers	-0.0731	-0.1558	0.0648	0.4729
Level of fatigue	0.0745	-0.4389	-0.0006	0.3359

The numbers in the table show factor loadings for the factors derived from the factor analysis in each question item. Factor loadings greater than 0.3 indicate moderate correlation between the item and the factor. Four factors derived from the factor analysis were named based on the question items with high factor loadings.

Stress in dealing with patients/families and co-workers, concern about medical malpractice, and fatigue had high factor loading for the "stress factor" category. With regard to multiple imputation, the number of incomplete data that required imputation were 37-134 of 732 total participants (5.32%-22.41%) (Data Supplement 1). The proportion of missing data was the highest in the factors extracted in the factor analysis, and the lowest in gender. Multivariable logistic regression analysis revealed that chronic insomnia was associated with long working hours, and the "stress factor"; the ORs were 1.02 (95% CI 1.01-1.03, per one-hour/week), and 1.46 (95% CI 1.13-1.90), respectively (Table 4). Sleep-aid use was associated with male gender, unmarried status, long shift (longer than 24 hours shift to cover nights), and the stress factor; the ORs were 1.71 (95% CI 1.03-2.86), 2.38 (95% CI 1.39-4.10), 1.86 (95% CI 1.22-2.85), and 1.48 (95% CI 1.13-1.94), respectively (Table 5).

Complete case analysis without imputation for missing data showed that in addition to long working hours and stress, male gender was inversely associated with chronic insomnia (Data Supplement 2). Regarding sleep-aid use, male gender, unmarried status, and stress were associated with sleep-aid use in the complete case analysis. In the complete case analysis, long shifts showed a trend toward increased sleep-aid use but did not reach statistical significance (OR 1.64, 95% CI 0.99-2.66) (Data Supplement 3). Variance inflation factors for items included in the multivariable logistic regression analyses were less than 2.2 and did not suggest the existence of multicollinearity.

DISCUSSION

This nationwide survey of early-career EPs in Japan during their initial emergency medicine (EM) board certification exam showed that approximately one-fourth of EPs had experienced chronic insomnia and one-fourth had tried sleep aids for their insomnia. Factors associated with chronic insomnia were long working hours and stress. Factors associated with sleep-aid use were male gender, unmarried status, and stress.

Previous studies have shown that insomnia and sleep-aid use among EPs worldwide is common. Mail-based and web-based studies on United States (US) EM residents and Canadian EPs reported the use of sleep-aid was 34.2-46.2%.[8-10] Unfortunately, these surveys had low response rates (16-49.6%), thereby limiting the ability to generalize this data and estimate the true rate of sleep-aid use in EPs. In 2014, a similar survey of US allopathic EM residents with a high response rate (72 %) found that 71% used chemical aids to stay awake or go to sleep.[11] This higher rate of chemical aids was most likely due to inclusion of stimulants such as coffee or energy drinks. Furthermore, a 2006 nationwide

Table 4. Multivariable logistic regression analysis for chronic insomnia.

Risk factor for chronic insomnia	Odds ratio (95% CI)	P-value
Male gender	0.64 (0.40 - 1.03)	0.06
Age	1.02 (0.98 - 1.06)	0.26
Unmarried	0.78 (0.46 - 1.32)	0.35
Child	0.89 (0.54 - 1.46)	0.64
Long shift	1.34 (0.88 - 2.04)	0.18
Working hours per week	1.02 (1.01 - 1.03)	<0.01*
Night shifts per month	1.00 (0.92 - 1.01)	0.92
"Educational and clinical system factor"	1.07 (0.80 - 1.43)	0.67
"Work condition factor"	0.76 (0.55 -1.04)	0.08
"Skill and knowledge development factor"	0.92 (0.70 -1.21)	0.56
"Stress factor"	1.46 (1.13 - 1.90)	<0.01*
Postgraduate year	1.27 (0.83 - 1.95)	0.27
Annual ambulance number	1.00 (1.00 - 1.00)	0.77
Attending number	1.00 (0.88 - 1.12)	0.96

*$P < 0.05$.
CI, confidence interval.

Table 5. Multivariable logistic regression analysis for sleep-aid use.

Risk factor for sleep-aid use	Odds ratio (95% CI)	P-value
Male gender	1.71 (1.03 - 2.86)	0.04*
Age	1.02 (0.98 - 1.06)	0.39
Unmarried	2.38 (1.39 - 4.10)	<0.01*
Presence of children	0.89 (0.50 - 1.56)	0.68
Long shift	1.86 (1.22 - 2.85)	<0.01*
Working hours per week	0.99 (0.98 - 1.01)	0.22
Night shifts per month	0.96 (0.87 1.06)	0.44
"Educational and clinical system factor"	0.84 (0.62 - 1.12)	0.23
"Work condition factor"	0.98 (0.72 - 1.34)	0.92
"Skill and knowledge development factor"	1.15 (0.88 - 1.51)	0.31
"Stress factor"	1.48 (1.13 - 1.94)	<0.01*
Postgraduate year	1.35 (0.86 - 2.12)	0.19
Annual ambulance number	1.00 (1.00 - 1.00)	0.44
Attending number	1.13 (1.00 - 1.28)	0.06

*$P < 0.05$.
CI, confidence interval.

study in the US focusing on EM residents of various levels of training revealed a 21.8% prevalence of past zolpidem use, with 9.3% reporting recent use.[22]

A 2019 web-based survey of EPs working in five EDs in Calgary, Canada, with a high response rate (73%), reported a rate of 56% of current pharmacologic sleep-aid use (95% CI 48-64%), which was significantly higher than previous studies. This may be due in part to a higher average age of respondents than prior studies, as more than half the participants were above the age of 39.[13] Most of these studies focused on EM residents; studies on practicing EPs post-training are limited. The issue of sleep-aid use is not limited to North American EPs. A web-based survey from Saudi Arabia reported that 36.6% of EPs, paramedics, and EM technicians use sleep-aids, and that an increase in use was associated with a higher average number of monthly night shifts.[12]

Another voluntary, anonymous, online cross-sectional study in Australia reported that 46.5% of EPs used medications such as melatonin, benzodiazepine, and

pseudoephedrine to manage their sleep and performance.[23] The response rate of these web-based studies is unclear due to unknown denominators. A study based on the Taiwanese National Health Insurance Research Database reported that the prevalence of insomnia was 5.56% and the percentage of hypnotic use was 19.96%.[24] This result was based on *International Classification of Diseases* codes and the prescription data recorded in the national database; it did not include self-treated insomnia or sleep-aid use without prescription. Therefore, it most likely underestimated the rate of insomnia and sleep-aid use.

Our study reveals a comparable prevalence of insomnia and sleep-aid use to the aforementioned international studies. This reported prevalence of insomnia is higher than the age-matched general Japanese population. A study conducted in 1997 on the general Japanese population showed the prevalence of insomnia in those aged 30-39 was 15.95%, while a 2008 study reported the prevalence of insomnia in the same age group was 11.7% in males and 10.3% in females.[14,15] The sleep-aid use in this age group appears to be 2.1-2.6%.[14] Moreover, it is possible that EPs in Japan may be more reluctant to use a sleep aid or report the use of sleep aids due to cultural views of sleep disturbance and substance use. Albeit a possible underestimation, these reported numbers are alarmingly high, especially considering that the participants are still early in their careers, with a presumed long career and subsequent stressors ahead of them. It is highly unlikely that our reported results were high only due to the participants' recent residency training, as one-third of them were PGY-10 or higher.

Several studies reported the prevalence of sleep-aid use in EPs, but there is little data about risk factors associated with insomnia and sleep-aid use. Understanding the factors associated with insomnia and sleep-aid use would lead to further studies regarding interventions to improve EPs' sleep. Although it was a subjective report, participants in a 2004 study suggested that work hours, demands of work, emotional stress from work-related activities, family commitments, and changing circadian rhythms were causing fatigue and difficulty in initiating sleep.[9] Another study found that the average monthly number of night shifts was associated with sleep-aid use.[12] Our study suggests that chronic insomnia is associated with long working hours and stress, and sleep-aid use is associated with stress, after excluding some non-modifiable factors.

We often discuss the need to limit the working hours and number of night shifts, and the importance of modifying the EP's work style (fewer working hours per week and shorter shifts) is further strengthened by the results of this study. It is worth noting that more than 90% of study participants reported working more than 40 hours a week, and more than 30% of them reported working longer than 24 hours to cover nights. There is no official recommendation regarding shift length for EPs in Japan; the length of shifts reported in this study seems much longer than recommended in France and the US.[25,26] In addition to work style, we also need to focus on physicians' stressors at the workplace to improve EPs' sleep cycles, as this study showed that the stress factor is associated with both chronic insomnia and sleep-aid use in Japanese EPs. Reducing the stress of EPs may improve the prevalence of insomnia or sleep-aid use.

LIMITATIONS

This study has some limitations. First, we collected this data from relatively young Japanese EPs. Those who have been practicing in EM longer may show a different pattern from the results we obtained in this study. The participants' recent intense EM residency training might have affected the results. The fact that all of them had just taken their board exam might have created additional stress for the participants, thus affecting the results. In addition, the results may not be applicable to EPs outside Japan whose cultural background and work styles are different from those within Japan. However, the previous studies showed similar patterns in other countries, and we think it is reasonable to estimate that EPs have a high prevalence of insomnia and sleep-aid use.

Secondly, survey-based data has some inherent biases, such as selection bias, measurement bias, and subject bias. The EPs who responded to the survey may have different sleep patterns and sleep-aid use habits from those who did not respond. However, the high response rate nearing 90% minimizes the possibility that this bias affected our study results. The subjective definition of insomnia by the participants may have affected the results. It is also not clear how many of the respondents who answered the questionnaire reported the truth due to social-desirability bias. Some people may feel that reporting experiencing insomnia could be perceived as a sign of weakness, and others may have felt a reluctance to report their use of sleep aids, thereby lowering the reported prevalence of insomnia and sleep-aid use. This bias was addressed by keeping responses anonymous and participation voluntary. Finally, due to the observational nature of the study, we could not determine any causal relationship between the factors listed above and insomnia or sleep-aid use, but rather an association.

CONCLUSION

This secondary analysis of a nationwide survey showed that Japanese emergency physicians have a high prevalence of insomnia and sleep-aid use early in their careers. Alcohol and benzodiazepine were the two most commonly used sleep aids reported. In addition to demographic background and work style such as longer work hours per week, stress was associated with chronic insomnia and sleep-aid use. Further studies are needed to investigate what intervention can improve EPs' sleep hygiene.

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Medical Malpractice and Diagnostic Errors in Japanese Emergency Departments

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Introduction: Emergency departments (ED) are unpredictable and prone to diagnostic errors. In addition, non-emergency specialists often provide emergency care in Japan due to a lack of certified emergency specialists, making diagnostic errors and associated medical malpractice more likely. While several studies have investigated the medical malpractice related to diagnostic errors in EDs, only a few have focused on the conditions in Japan. This study examines diagnostic error-related medical malpractice lawsuits in Japanese EDs to understand how various factors contribute to diagnostic errors.

Methods: We retrospectively examined data on medical lawsuits from 1961-2017 to identify types of diagnostic errors and initial and final diagnoses from non-trauma and trauma cases.

Results: We evaluated 108 cases, of which 74 (68.5%) were diagnostic error cases. Twenty-eight of the diagnostic errors were trauma-related (37.8%). In 86.5% of these diagnostic error cases, the relevant errors were categorized as either missed or diagnosed incorrectly; the others were attributable to diagnostic delay. Cognitive factors (including faulty perception, cognitive biases, and failed heuristics) were associated with 91.7% of errors. Intracranial hemorrhage was the most common final diagnosis of trauma-related errors (42.9%), and the most common initial diagnoses of non-trauma-related errors were upper respiratory tract infection (21.7%), non-bleeding digestive tract disease (15.2%), and primary headache (10.9%).

Conclusion: In this study, the first to examine medical malpractice errors in Japanese EDs, we found that such claims are often developed from initial diagnoses of common diseases, such as upper respiratory tract infection, non-hemorrhagic gastrointestinal diseases, and headaches.
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INTRODUCTION

Diagnostic errors may occur in approximately 5% of cases in initial outpatient settings,[1] while the error rate is 12% in emergency department (ED) settings.[2] Studies have suggested that all patients encounter at least one diagnostic error in their lifetime.[3] The ED environment is generally considered to create high-stress levels and is associated with high rates of medical staff sick leave and turnover, burnout, and early retirement globally.[4,5] High-stress environments are also more likely to result in patient safety incidents.[6]

Japan's emergency care system differs from that of other countries: As of 2017, the number of EDs in Japan (approximately 4,000) and the number of certified emergency specialists (approximately 4,500) are almost equal, meaning that there are few specialists in each ED.[7,8] Emergency physicians are required to train for at least three years at an accredited facility recognized by the Board of Emergency Medicine Moreover, those who have experience in situations such as cardiopulmonary resuscitation and focused assessment with sonography for trauma cases, as well as 20 emergency diseases such as cardiopulmonary arrest and shock, and have passed a written examination, become a specialist.[9] Additionally, there are not many people in Japan who claim to be solely emergency physicians.

Since the board certification system for emergency physicians was officially launched in 2007, the number of applicants has remained at 300–400 per year.[10] Therefore, care in the ED is often provided by non-emergency specialists (such as other physicians or surgeons, depending on each hospital policy, alongside their regular duties) in high-stress settings, creating an environment that might be prone to diagnostic errors and many medical malpractice lawsuits. In other countries, there have been several investigations of medical malpractice in the ED, suggesting that diagnostic errors and procedural problems contribute to malpractice.[11-13] However, few studies have examined diagnostic error-related malpractice in Japanese EDs.

While in this study we used data from the largest legal database in Japan, the resulting number of cases is quite small compared to the number of such cases that occur in the United States (US). According to the Japanese Supreme Court report, approximately 300–700 medical lawsuits are adjudicated each year in Japan, including those heard in brief and district courts,[14] meaning that Japan has only about 5% of the number of medical malpractice cases as the US.[15] The purpose of this study was to identify error-prone initial and final diagnoses using data from medical malpractice lawsuits related to diagnostic errors that occurred in Japanese EDs and to create awareness among working emergency specialists.

Population Health Research Capsule

What do we already know about this issue?
In Japan non-emergency specialists often provide emergency care, which frequently leads to diagnostic errors and associated medical malpractice.

What was the research question?
We examined diagnostic error-related medical malpractice lawsuits that involved Japanese emergency departments (ED).

What was the major finding of the study?
We evaluated 108 cases, of which 74 (68.5%) were related to diagnostic errors.

How does this improve population health?
Awareness of the frequency of diagnostic errors in the ED and initial diagnosis can help reduce future errors.

MATERIALS AND METHODS

Study Design

For this study, we collected cases from the largest database of litigation in Japan (Westlaw Japan K.K.).[14] The database contains information on more than 200,000 lawsuits of all types, from which we extracted data on medical lawsuits from 1961-2017. All litigation data in the database were anonymized, but all the medical information data used in this study could be extracted. In Japan, unlike in the US and the United Kingdom, the jury system was implemented between 1923-1943 and resumed in 2009.[16] As a result, for most of our history, trials by jury have not been held and were instead conducted by certified judges.

Setting and Participants

Permutational combinations of "medical claims," "medical malpractice," "medical lawsuits," "diagnostic errors," "misdiagnosis," and "delayed diagnosis" were used as keywords related to claims. We combined all claim cases into a single tabular list (3,430 cases). Before extracting the data, the corresponding author and a senior medical student licensed to practice law established exclusion criteria, namely 1) duplicate cases, 2) intentional crimes, 3) robberies, 4) money disputes, and 5) veterinary claims.

We excluded 751 duplicate cases, 707 cases that met the exclusion criteria, 34 cases that constituted an "unfair suit" (defined as a claim that a lawyer decides is unreasonable), 136 cases with a non-physician defendant, and 1,693 cases that were not related to the ED (Figure).

Ethics

This study is based on data that has already been published as legal proceedings and is part of the public record; thus, patient consent was not required. Institutional review board approval was not required and was waived by the university hospital.

Variables

The data used in this study included patient background (age, gender, treatment outcome, initial diagnosis, final diagnosis, and whether the case was trauma-related); physician characteristics (department and clinical setting); and litigation details (duration, sequelae, medical outcomes, judgment, and billing indemnity amount). Among litigation details, the term " judgment " is

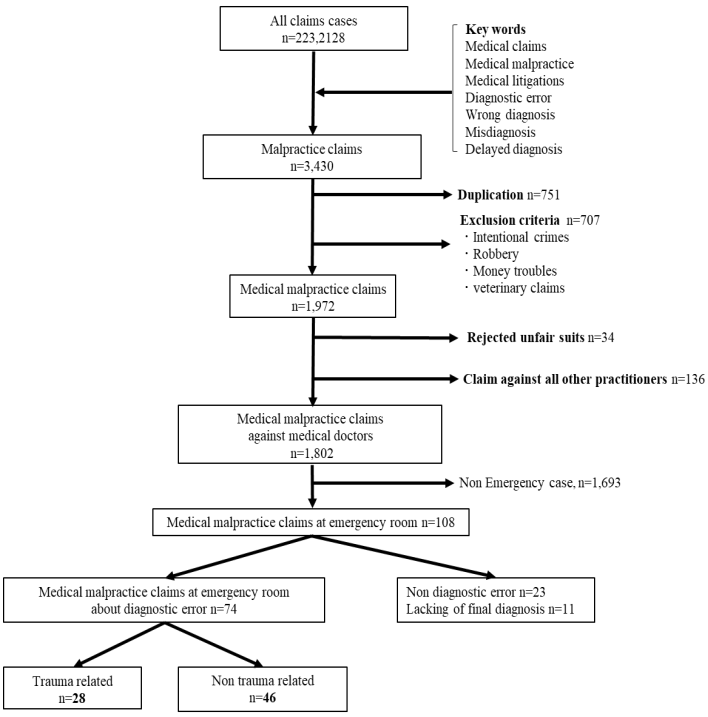

Figure. Participant flowchart. Medical lawsuits in Japan from 1961-2017.*
*From the total number of lawsuits, "medical claims," "medical malpractice," "medical litigation," "diagnostic error," "wrong diagnosis," "misdiagnosis," and "delayed diagnosis" were used as keywords to identify cases. Exclusion criteria and unfair suits were defined as claims that a lawyer decides are unreasonable.

defined as the judgment of a court of law. Additionally, the term " billing amount " is the amount the patient's attorney requested prior to trial. The term " indemnity paid " is defined as the amount ordered to be paid by a court judgment. Doctor specialty classification was based on the Japanese medical specialty board (2019).[17] All of the targeted cases were labeled as diagnostic error-related claims (DERC) or non-DERC by the three university students and confirmed by the three co-authors.

The papers were first evaluated by two people in a blind and independent environment, of which seven cases (93.5% concordance rate) were discordant between the two evaluators, and a third person made the final evaluation of the discordant cases. The evaluating authors are all general medicine doctors trained at medium-to-large hospitals in Japan, which are the only facilities of the 552 total hospitals in the country where emergency medicine specialization can be obtained.[9] In these hospitals, general medicine is the main specialty, but EDs handle over 5,000 emergency cases per year. These hospitals see emergencies far more than the other hospitals in Japan, as 45.1% of hospitals with EDs receive fewer than 360 ambulances per year.[18] Moreover, one of the authors still works in the ED and teaches residents. As mentioned above, this type of department has led to many generalists working as emergency physicians.

To minimize bias during the case review, we used common definitions of diagnostic error: "delay in diagnosis" and "missed or wrong diagnoses."[19] The final diagnosis of non-trauma cases was confirmed by analyzing the database, while case classifications were determined through consultation with the two authors who are general medicine doctors with several years of experience working in the ED. The cases were categorized into four categories. The first three (infection, tumor, and vascular disease) account for about 74% of medical claims due to diagnostic errors in the US and are known as the "Big 3"; other cases were combined into a fourth category.[20]

Judgments were decided final if made by the Supreme Court, high courts, or local district courts.

Main Outcomes

The main outcomes for the study were the type of diagnostic error, the final diagnosis assessed from the initial diagnosis of non-trauma cases, and the diagnostic classification of trauma cases.

Data Analysis

All payment values were adjusted to the 2017 equivalent using the Japanese Consumer Price Index (available at https://www.stat.go.jp/data/cpi/, Japanese Ministry of Internal Affairs and Communications). We converted each payment amount from Japanese yen to US dollars (¥110 = $1 on March 20, 2020). Continuous variables are presented as median values, and interquartile ranges (IQR); categorical variables are presented as numbers and proportions (%) of the corresponding cases. We used JMP PRO software version 13.0 (SAS Institute, Cary, NC,) for all calculations.

RESULTS

We evaluated a total of 108 cases in this study; 74 (68.5%) of the cases were related to diagnostic errors. Twenty-eight of the diagnostic errors were trauma-related (37.8%) (Figure). The frequency of diagnostic errors of all types (missed or wrong diagnoses and diagnostic delay) within the ED leading to medical malpractice lawsuits was 68.5%. The mean age of the patients was 32 years (IQR 16-54), and 66.7% were men. The median claim amount was $443,155 (IQR $232,295-$689,239), 42.6% of the cases ended with a judgment in the favor of the plaintiff, and the median amount of the judgment was $30,393 (IQR $0-$291,593). The median duration of litigation was six years, with a mortality rate (the patient died before receiving a judgment) of 79.6%; the median claim amount of diagnostic error cases was $449,759 (IQR $227,199-$684,875); 59.5% of the cases ended with a judgment in favor of the plaintiff of diagnostic error cases; and the median amount acceptance of diagnostic error cases was $224,121 (IQR $53,106–$388,336).

Error types consisted of missed or wrong diagnosis in 86.5% of cases and diagnostic delay in 13.5% (Table 1).The departments involved in examining the cases of diagnostic

Table 1. Findings of emergency department medical malpractice study in Japan 1961-2017.*

Characteristics	Median (IQR) or number (%) N=108
Patient age (IQR)	32 (16–54)
Male gender, number (%)	72 (66.7)
Adjusted total billing amount ($)	443,155 (232,295–689,239)
Claims with final judgment resulting in payment (%)	46 (42.6)
Adjusted median indemnity paid amount ($)	30,393 (0–291,593)
Duration of claim (years)	6 (5–7)
Outcome	
Deaths (%)	86 (79.6)
Sequelae (%)	20 (18.5)
Full recovery (%)	2 (1.9)
Cases of diagnostic error (%)	74 (68.5)
Characteristics of diagnostic error cases	**Median (IQR) or number (%) N= 74**
Adjusted total billing amount of diagnostic error cases ($)	449,759 (227,199–684,875)
Claims with a final judgment resulting in payment of diagnostic error cases (%)	44 (59.5)
Adjusted median indemnity paid amount of diagnostic error cases ($)	224,121 (53,106–388,336)
Duration of claim of diagnostic error cases (years)	6 (5–7)
Outcome of diagnostic error cases	
Deaths (%)	61 (82.4)
Sequelae (%)	10 (13.5)
Full recovery (%)	2 (2.7)
Error type	
Missed or wrong diagnosis (%)	64 (86.5)
Diagnostic delay (%)	10 (13.5)
Trauma related (%)	28 (37.8)

*This study collected data on medical malpractice lawsuits from 1961-2017.
The billing amounts and indemnity paid amounts were adjusted to the 2017 equivalent using the Japanese Consumer Price Index (shown in US dollars).
IQR, Interquartile range.

error in the ED were the following: internal medicine in 27 cases (36.5%); surgery in 24 cases (32.4%); pediatrics in seven cases (9.5%); and EDs in only three cases (4.1%). Intracranial hemorrhage was the most common final diagnosis of trauma-related errors in 12 cases (42.9%), followed by digestive system disease in 10 cases (35.7%), and pulmonary system disease in four cases (14.3%). Traffic injury was the most common trauma-related diagnosis in 15 cases (53.6%), and four of the five alcohol-related cases had a final diagnosis of intracranial hemorrhage (Table 2).

The final diagnoses of non-trauma-related diagnostic errors were related to the vascular system in 18 cases (39.1%), infection in 16 (34.8%), and other in 12 (26.1%); no cases were tumor-related. The most common vascular diseases were acute myocardial infarction and subarachnoid hemorrhage, with five cases each. The most common infections were epiglottitis and meningitis, with four cases each (Table 3).

The most common initial diagnoses of non-trauma-related errors were upper respiratory tract infection (10 cases, 21.7%), non-bleeding digestive tract disease (seven cases, 15.2%), and primary headache (five cases, 10.9%). When the initial diagnosis of upper respiratory tract infection was made, the most common final diagnosis was epiglottitis (four cases, 40%). When the initial diagnosis of non-bleeding digestive tract disease was made, the most common final diagnosis was peritonitis (three cases, 42.9%). When the initial diagnosis of primary headache was made, the most common final diagnosis was subarachnoid hemorrhage (three cases, 60.0%) (Table 4).

DISCUSSION

In this study we analyzed 108 medical lawsuits in Japanese EDs and confirmed that 68.5% were due to diagnostic errors. Of these, we examined in detail 74 medical malpractice cases due to diagnostic errors in the ED. The settlement rate was 59.5%, and the amount accepted was $224,121 (IQR $53,106–$388,336). The mortality rate was 82.4%. The settlement rate was 59.5%, and the amount accepted was $224,121 (IQR $53,106–$388,336). The mortality rate was 82.4%.

The most common trauma-related final diagnosis was intracranial hemorrhage, while the most common non-trauma-related final diagnosis was associated with the vascular system. The most common initial diagnoses were upper respiratory tract infection, non-bleeding digestive tract disease, and primary headache. For some of these cases, the initial diagnoses were in different disease group categories than the final diagnoses. To make the results of the survey in Japan easier for readers to understand, we will focus our discussion on the following five points: 1) background of medical litigation and diagnostic errors; 2) differential diagnoses prone to diagnostic errors; 3) trauma-related errors; 4) initial diagnosis with particular attention to non-traumatic diagnostic errors; and 5) future prevention and countermeasures.

Background of Medical Litigation and Diagnostic Errors

Several previous studies reported that the judgment for the plaintiff rate was 13.3% in the ED setting for medical malpractice in Taiwan[21] and 31% in 2020 in the US.[11] Diagnostic errors were involved in 35–37% of the medical lawsuits in the ED in the US.[22,23] This is considerably lower

Table 2. Trauma-related diagnostic error in the emergency department (n=28): a medical malpractice study in Japan 1961-2017.*

Trauma final diagnosis	Total number	Traffic injury n, (%)	Alcohol-related n, (%)	Others n, (%)
Intracranial hemorrhage	12	4 (33.3)	4 (33.3)	4 (33.3)
Trauma bowel injury	10	6 (60)	1 (10)	3 (30)
Pulmonary	4	3 (75)	0	1 (25)
Musculoskeletal system	2	2 (100)	0	0

*Trauma-related errors were divided by disease group and categorized as traffic-related, trauma-related, alcohol-related, and others.

Table 3. Non-trauma related final diagnosis (n=46).*

Disease	Total n (%)
Vascular	18 (39.1)
Acute myocardial infarction	5 (10.9)
Subarachnoid hemorrhage	5 (10.9)
Aortic dissection	4 (8.7)
Infection	16 (34.8)
Epiglottitis	4 (8.7)
Meningitis	4 (8.7)
Peritonitis	3 (6.5)
Tumor	0
Others	12 (26.1)
Bronchial asthma	2 (4.3)
Acute pancreatitis	2 (4.3)
Intestinal obstruction	2 (4.3)

*Most common non-trauma categories of malpractice suits related to diagnostic error; % is percentage of total number.

than the rate in Japan (68.5%). In the US, the emergency physician was the most common specialist who made errors in the ED (19%), followed by internists, family physicians, orthopedic surgeons, and general surgeons.[23] The differences between the present study and others may be due to the differences in trials and culture in each country, and the fact that only relatively serious cases are brought to trial due to the small number of medical lawsuits in Japan (approximately 1/21 of those in the US) as a fundamental background.[15]

In the present study, there were many vascular final diagnoses and no tumor-related errors. This may have been influenced by the differences in ED systems and insurance systems between Japan and the US. Japan's emergency call system allows patients to call an ambulance for free, and there are no rules such as the Emergency Medical Treatment and Active Labor Act.[8] Therefore, emergency physicians can refuse ambulances at their discretion. It is common for patients to be rejected by multiple hospitals after boarding an ambulance. Although the rate of diversion from one hospital to another is not published, according to the 2020 data, it took an average of 30 minutes from emergency medical service arrival at the scene to an accepting hospital arrival.[24] As the emergency medical team attempts to find a hospital, the patient's vital signs are likely to collapse, as cardiovascular disease and other time-sensitive conditions may worsen. Consequently, the emergency physician may make further diagnostic or treatment errors, due to lack of specialty expertise that warrants the transfer.

Differential Diagnoses Prone to Diagnostic Errors

A previous study of diagnostic errors in the ED showed that the top three results in the US were vascular (39.6%), infection (21.2%), and tumor (7.9%).[20] According to three studies of US medical lawsuits, the most common final diagnoses related to diagnostic errors in the ED are acute myocardial infarction, appendicitis, pulmonary embolism, and fractures.[11,22,23]

Trauma-related Errors

As for trauma-related errors, data from previous studies that only evaluated trauma-related cases are scarce and not comparable. However, the findings of this study suggest that when patients reach a hospital with alcohol-related trauma, more attention should be paid to the presence of a latent intracranial hemorrhage (with errors in 33% of cases).

Initial Diagnosis with Particular Attention to Non-traumatic Diagnostic Errors

In this study the most common initial erroneous diagnoses in non-trauma-related diagnostic errors were upper respiratory tract infection, non-bleeding digestive tract disease, and primary headache. Previous studies have reported low concordance rates for the initial diagnosis of upper respiratory tract infections in the ED.[25] In connection with the results of this study, we need to consider the possibility that patients presenting with upper airway symptoms in the ED may have a different initial diagnosis. Gastroenteritis is often given as an initial diagnosis of patients who ultimately are diagnosed with cerebellar hemorrhage in the ED and primary care,[26] and even in cases where gastrointestinal disease is suspected, it is important to conduct a detailed history and physical examination because it may not be of gastrointestinal symptoms.[27,28]

For primary headache, it was reported that 36% of subarachnoid hemorrhage cases were diagnosed with primary headache, such as migraine or muscle tension headache, at the first visit.[29] Of those diagnosed with tension-type headache, 50.2% had a different final diagnosis, and 30.3% of those patients were diagnosed with secondary headache.[30] Another previous study found that the most common diagnostic error in patients discharged with nonspecific headache was ischemic

Table 4. Top three initial diagnoses of cases of diagnostic errors in non-trauma cases and their final diagnosis.*

Initial diagnosis (total number)	Final diagnosis of 1st rank n, (%)	Final diagnosis of 2nd rank n, (%)	Final diagnosis of 3rd rank n, (%)
Upper respiratory tract infection 10	epiglottitis 4 (40)	meningitis 2 (20)	appendicitis, pneumonia, cerebral stroke, heat illness 1 (10)
Non-bleeding digestive tract disease 7	peritonitis 3 (42.9)	subarachnoid hemorrhage 2 (28.6)	intestinal obstruction, intestinal invagination (intussusception) 1 (14.3)
Primary headache 5	subarachnoid hemorrhage 3 (60)	cerebral stroke 2 (40)	

*Initial and final diagnoses of non-traumatic diagnostic error cases arranged by rank; % is percentage of the total number of each initial diagnosis.

stroke (18%).[31] Previous studies have pointed out that it is important to be aware of the "red flag" signs of headache (new onset in patients over 50 years old with impaired consciousness, thunderclap headache, worst headache ever experienced, altered mental status, nausea/vomiting, focal neurological deficits, etc).[32]

Future Prevention and Potential Strategy

A previous study has shown that physicians who have faced medical malpractice lawsuits gravitate toward "defensive medicine" such as excessively ordering tests, performing diagnostic procedures, and referring patients for consultation and that they become "more conservative" such as avoiding trauma surgery and patients who suffer from complex medical problems.[33] So we should consider how to reduce the number of medical malpractice occurrences caused by diagnostic errors in the ED setting. For example, a previous study reported that outpatient follow-up after an ED visit reduces patient mortality,[34] and that improving teamwork, patient engagement, and learning from diagnostic errors are also effective methods.[35] Other reports suggest that failure to assess, communicate, and respond to ongoing symptoms is a common error made by clinicians in the ED and that more attention is needed.[36] Understanding and addressing error-prone situations in this way will help reduce errors.

It is also important to reconsider a diagnosis when a differential diagnosis does not match the symptoms, signs, or tests and to consider the possibility of uncommon or common atypical cases after ruling out common diseases to reduce errors.[37] Therefore, the initial and final diagnosis figures that led to the lawsuits in this study could be used as part of a checklist to reduce errors in the ED, which could lead to fewer errors in the future. The use of cognitive forcing tools by clinicians in busy settings such as EDs has been reported to have a positive subjective impact on diagnostic accuracy and thoughtfulness.[38] In the Netherlands, the number of patients coming to the ED has increased since the number of emergency specialists has increased; however, the number of medical malpractice suits has decreased.[12] In Japan, the number of emergency specialists has increased threefold between 2004-2017,[7] and the trend of diagnostic errors in the ED is likely to change. This will need to be assessed with further research. However, we think it is important to increase the number of emergency specialists.

LIMITATIONS

This study has several limitations. First, while we used the largest database of medical malpractice in Japan, it does not cover all medical claims nor does the database include out-of-court settlements. Therefore, it is unclear to what extent settlements occurred prior to medical malpractice. In addition, the information was based on a database of medical lawsuits, and it was difficult to analyze confounding factors in the social environment, changes in the legal system, or the trends of the forms of claims with the development of technology in medicine. Second, it is unclear from this database to what extent diagnostic errors in Japan lead to medical malpractice claims, as there is no actual data on existing diagnostic errors. Third, the database is anonymized trial data, which means that the personal information of the medical personnel in charge cannot be extracted, making it less than ideal for research on diagnostic errors. Fourth, as the database is based on Japan's judicial administrative system, it is difficult to make simple comparisons with other countries in terms of the amount and rate of medical malpractice occurrence.

Finally, the system of emergency care in Japan is very different from that in other countries; thus, a simple comparison may be difficult in this respect as well. Despite these limitations, to the best of our knowledge, this is the first and largest study to investigate medical malpractice related to diagnostic errors in Japanese EDs; as such, it could influence future efforts to improve patient safety in EDs.

CONCLUSION

Of the 108 malpractice claim cases we analyzed that occurred in Japanese EDs, we identified that 68.5% of the cases were due to diagnostic errors. Specifically, relatively common conditions at the initial visit, such as upper respiratory tract infection, non-hemorrhagic gastrointestinal diseases, and primary headache diagnosis, were serious

illnesses and resulted in medical litigation, which stood out in our extracted claims cases. The emergency care setting is demanding and challenging for physicians; future research is needed to determine the true causes and the strategies that should be used to prevent diagnostic errors.

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Potentially Critical Driving Situations During "Blue-light" Driving: A Video Analysis

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Introduction: Driving with warning lights and sirens is highly demanding for ambulance drivers, and the crash risk is much higher than that during normal driving. In this study our goals were to establish a coding protocol to observe how often and how long potentially critical driving situations (PCDS) occur during "blue-light" driving (driving with emergency response lights) and to describe traffic and environmental conditions preceding and accompanying the PCDS.

Methods: We collected randomly drawn video data of real ambulance driving between 2014–2017 in two German federal states. A coding protocol was developed to categorize PCDS into four types ("right of way," "crosswalks," "overtaking" [passing], and "other") and to describe them within the context of road characteristics, incident type, traffic, weather conditions, and driving style.

Results: A total of 172 videos of 71 different drivers were chosen randomly covering 1125 minutes of driving with warning lights and sirens. The drivers had a mean age of 33.7 years, and 25.4% were female. A total of 2048 PCDS occurred with a mean duration of five seconds (range of 1-66), amounting to one PCDS every 33 seconds. Twenty percent of the driving time involved PCDS. The rapid driving style (10.5%) showed more PCDS (one every 28.5 seconds), and the defensive driving style showed fewer PCDS (one every 49.6 seconds). Of all detected PCDS, "right of way" situations (57.5%) were most frequent, followed by "overtaking" [passing] maneuvers (30.2%).

Conclusion: This study used a detailed coding protocol to describe driving with warning lights and sirens. The PCDS occurred less frequently than anticipated, although they were still common events when driving an ambulance, representing significant potential for crashes or near-crashes. These results can be used for insight training programs to raise ambulance drivers' awareness of typical PCDS and associated potential crash risk. [West J Emerg Med. 2023;24(2)348–358.]

INTRODUCTION

Driving emergency vehicles with warning lights and sirens has a much higher crash rate than normal driving. In Germany, the rates were found to be fourfold for fatal crashes, eightfold for serious injuries, and seventeenfold for material damage.[1,2] In other countries, the crash rates for emergency vehicles have been reported as three to five times higher than non-emergency driving.[3,4] Emergency vehicle crashes not only affect directly involved persons but also result in delayed help at the actual emergency scene and in the broader community. They further involve more people with injuries compared to crashes of similar-sized vehicles.[5,6]

Emergency vehicle crashes are often caused by their drivers[1] and occur most often at intersections and in overtaking [passing] situations.[1-7] Previous studies have reported critical driving situations occurring every 19 seconds during emergency lights usage ("blue-light" driving).[1,2] Critical driving situations have been defined as situations that involve risky driving behavior by emergency vehicle drivers,[2] by other road users,[8] or regarding perception time for evasive

maneuvers.[9] Operationalization often includes crashes or near crashes[9] as well as driving triggers.[10-12] The analyses of near crashes in naturalistic driving studies can be evaluated with triggers from accident recording systems,[10-12,13,14,15] and video analyses of drivers' reactions to incidents or distracting behaviors.[16,17] The use of front cameras allows the analysis of normal driving from the drivers' perspective.

To our knowledge, the only available video data for critical driving situations during emergency driving with warning lights and sirens was reported in 1972.[2] Since then, a number of technical (eg, driver assistance systems or vehicle construction), organizational (eg, training possibilities), and traffic (eg, increasing volume) conditions have changed. In this study we aimed to provide up-to-date data on potentially critical driving situations (PCDS). Our first objective was to establish a coding protocol to analyze video data of real emergency driving for PCDS regardless of whether they resulted in hazards or increased crash risk. We define PCDS as driving situations where ambulance drivers need heightened attention due to violating traffic regulations (eg, running a red light), stretching traffic regulations (eg, overtaking another vehicle in uncommon situations), and driving differently than normal (eg, crossing road markings to have more space), or when reactions due to traffic conditions are necessary. Against this background, the second objective was to describe the type and frequency of PCDS during emergency driving as well as traffic and environmental conditions preceding and accompanying the PCDS.

The results of this study are intended primarily for research on accident causes and risks associated with blue-light driving. Subsequently, they can be used in training courses for blue-light drivers to adapt their driving behavior. In addition, they can help co-drivers to have a positive influence on driving behavior. Emergency physicians would benefit from these changes as it is in the interest of all involved to make blue-light driving as safe as possible.

Population Health Research Capsule

What do we already know about this issue?
Crash risk is higher in emergency driving. The characteristics of potentially critical driving situations (PCDS) that can cause accidents are still unclear.

What was the research question?
Our goal was to develop a coding protocol and to quantify type and frequency of PCDS during real-life emergency driving.

What was the major finding of the study?
Every 33 seconds a PCDS of about 5 seconds occurs during driving with warnings lights and sirens; 57.5% are right-of-way situations.

How does this improve population health?
Knowing potentially critical situations during emergency driving may improve driver training, reduce accident rates, and ensure rapid assistance in emergencies.

METHODS

Data Collection

Driving data of paramedics from different rescue services during regular work shifts were recorded in the context of a training evaluation study between October 2014–June 2017 in two German federal states.[18] The Ethics Committee at the Faculty of Medicine of Ludwig-Maximilians-University Munich approved the study (ID: 206-14), and all participants gave written informed consent. Data collection took place in rural and urban areas at all times of day. Two different ambulance vehicle types were included: rescue transport vehicles ("RTV," a light truck of approximately 4.7 tonnes, staffed with at least one emergency medical technician (EMT) as driver and one paramedic as co-driver) and emergency physicians' response vehicles ("NEF," usually a car less than 3.5 tonnes, staffed with one EMT or paramedic as driver and an emergency physician. Both vehicle types typically respond to emergencies. While the RTV is responsible for transporting patients to the hospital, the NEF brings the emergency physician and necessary equipment to the scene (so-called "rendezvous system"). The vehicles were equipped with cameras to record traffic in front of them, without audio recording. Recording started when the ignition of the vehicle was turned on and ended 10 seconds after it was turned off.

Video Data

For this study, we used video data of driving with lights and sirens to an emergency scene to identify PCDS. All driving of an emergency vehicle by the participants in several work shifts was recorded. As several operations did not include driving with warning lights and sirens, we included 1-4 emergency driving videos of sufficient length for each participant. Sufficient length was defined as a duration of 4-10 minutes. The minimum and maximum were set according to the mean of all driving times to an emergency scene (M = 6:04 minutes [min]; SD = 3:34 min) to avoid unrepresentative drives. The upper limit corresponds to the mean plus SD, rounded up. The same calculation for the lower limit would have been at about 2.5 min, assuming per the literature[1-2] that a critical event should occur approximately every 19 seconds; however, only 7-8 events would occur in 2.5 min and, thus, significantly fewer than in the longer videos. Therefore, it was decided to raise the lower limit to 4 min.

We included the videos if they met the following criteria: 1) the videos showed a drive to an emergency scene with lights

and sirens with 2) a driving time between 4-10 minutes. If no video with a driving time of sufficient length was available, two shorter (third step) videos were randomly drawn. Only when the recordings from a participant did not contain one video with a sufficient length or two shorter ones, one longer video was selected (fourth step). All drawings were made randomly via the numbered list of videos and the random function of Excel (Microsoft Corporation, Redmond, WA).

A total of 4,487 videos with 27,356 minutes of recordings met the first inclusion criterion (drive to an emergency scene). Of these videos 2,749 with 17,330 minutes of recordings met the second inclusion criterion (driving time between 4-10 minutes). Along with stratification for the driver, 172 videos totaling 1,125 minutes from 71 participants were drawn randomly. The characteristics of these drivers are presented in Table 1. This table indicates that the included video data capture different driving environments and experienced as well as inexperienced drivers.

Table 1. Characteristics of the included drivers.

	N	Mean	SD	Range
Age (years)	71	33.7	9.5	20 to 65
Working experience (months)	70	127.8	103.4	12 to 456
Average monthly driving time of ambulance vehicle (hours)	66	88.0	54.2	8 to 192
Driving license possession (years)	71	14.9	8.8	2 to 44
Gender				
18 (25.4%) female				
53 (74.6%) male				
Possession of driving licenses				
9 (12.7%) licenses for cars and small trucks (basic prerequisite for driving RTV)				
54 (76.1%) basic prerequisite, plus 1 or 2 more licenses for motorcycles, trucks, or trailer				
8 (11.3%) licenses for cars, small trucks, trucks, motorcycles, and trailer				
Place of operation of the driver				
43 (60.6%) urban (>30,000 residents)				
21 (29.6%) suburban (periphery of bigger cities or between 10,000 and 30,000 residents)				
7 (9.9%) rural (<10,000 residents)				

RTV, rescue transport vehicle; *SD*, standard deviation.

Coding Protocol

To identify PCDS in the video recordings, we used categorization based on a coding protocol. As described above, PCDS were defined as driving situations where ambulance drivers need heightened attention due to violating traffic regulations (e.g., running a red light), stretching traffic regulations (such as overtaking another vehicle in uncommon situations), and driving differently than normal (eg, crossing road markings to have more space), or when a reaction due to traffic is necessary. To develop the coding protocol the existing protocol was adapted and extended.[2] In that it was differentiated between critical driving situations (pulling into moving traffic, jumping red traffic lights, intersections without traffic lights, as well as overtaking in traffic jams, standing traffic in front of red lights, on straight roads, in bends, on road gradients or on two-lane streets), wrong reactions of ambulance drivers (overtaking on the right, driving the wrong way, completely using the oncoming lane for overtaking, impeding other drivers in forming a corridor for the emergency vehicle ["*rettungsgasse*," a specific German term similar to the American or Canadian "move over" laws] by signaling the wrong direction, jumping red lights without adequate deceleration and disregarding the right of way without deceleration), and wrong reactions of other road users (sudden braking, accelerating before the ambulance, accelerating before sudden braking, hindering to form a corridor for the emergency vehicle, and no swerving to give way).[2] The authors used 54 minutes of driving data to analyze critical driving situations.

For the development of our coding protocol, a total of 212 minutes of recordings were rated by three observers, one of whom was a study author. During development, the protocol was discussed and adapted iteratively to increase its clarity and interrater agreement. For this iterative process there were two sets of videos, 10 (85 min) in the first set and another 20 (127 min) in the second set. Usually, two of the three observers viewed a portion of the video sets, discussed ratings, and refined the protocol. Therefore, videos were sometimes rated multiple times when the protocol was changed in relevant points.

The differences between the final protocol and the older coding protocol[2] are as follows: the false reactions of other road users are not coded; and our categories (types) involve all critical driving situations except for overtaking on road gradients. Additionally, other driving situations are coded (eg, yellow/green lights, roundabouts, pedestrians, other vehicles with warning lights and sirens, and animals). All PCDS were coded in more detail and with better comparability concerning road class, other traffic (traffic density, cross and oncoming traffic), number of lanes, duration, reaction, and road, weather, and lightning conditions. For each video, the driving style was coded. The final protocol with detailed information on the coding and examples can be found in Supplemental Files A (German version) and B (English version).

Each video was first searched for primary observation units ("types"): "right-of-way" situations, "crosswalks," "overtaking" maneuvers, and "other" situations. Subsequently, for every type, the following subcategories were coded for each incident if relevant: *road class; incident type; size, traffic density; cross traffic; oncoming traffic;* and *traffic in driving direction.* We further coded *road, weather and lighting,* as well as *reaction to*

incident, for each PCDS. The *reactions to incident* was the only subcategory with multiple coding. Seven different reactions (no reaction/consistent driving; swerving; braking without stopping; stopping/braking to a halt; accelerating; stopping acceleration; and turning/using an alternate route) are included in the protocol and could be combined to describe these reaction in detail. For example, the emergency driver could only brake or both brake and swerve due to a PCDS. All reaction descriptions could be combined except for the "no reaction" code.

Additionally, for all incidents, the *duration* was coded, and raters could give a qualitative comment to provide context for the incident. For each video, the *driving style* was subjectively coded for each driver on a three-point scale (1 - defensive, 2 - normal, and 3 - rapid). In each case we performed the coding of the driving styles after the entire video was evaluated. Subjective assessment of the driving style was based on accelerating after intersections, keeping distances, exceeding speed limits, and sharp steering behavior. A defensive driving style was characterized by steady and predictable driving. A rapid driving style was characterized by reduced following distances, speeding, and abrupt steering maneuvers. Figure 1 shows an overview of the coding process.

The last step before finalization of the coding protocol was a test with the same three raters using nine randomly drawn videos covering 62 minutes of driving. The interrater reliability of type classification using Fleiss kappa was 0.785 when all three raters coded a PCDS. A total of 54.4% of the PCDS were detected by all three raters; another 19.8% were detected by two raters. The missing detection was often due to the length of the incidents. For overtaking maneuvers, for example, it was possible to code one long incident or two or more shorter ones. To improve the reliability of classification we added instructions on when to start a new incident to the coding protocol. After final adjustments of the coding system a fourth rater was instructed to use the protocol. Training was performed with already coded video recordings until the fourth rater was able to use the coding protocol as reliably as possible. Video recordings used for the development of the coding protocol were not included in the later analyses since changes in the protocol were not compatible with the coding of older protocol versions.

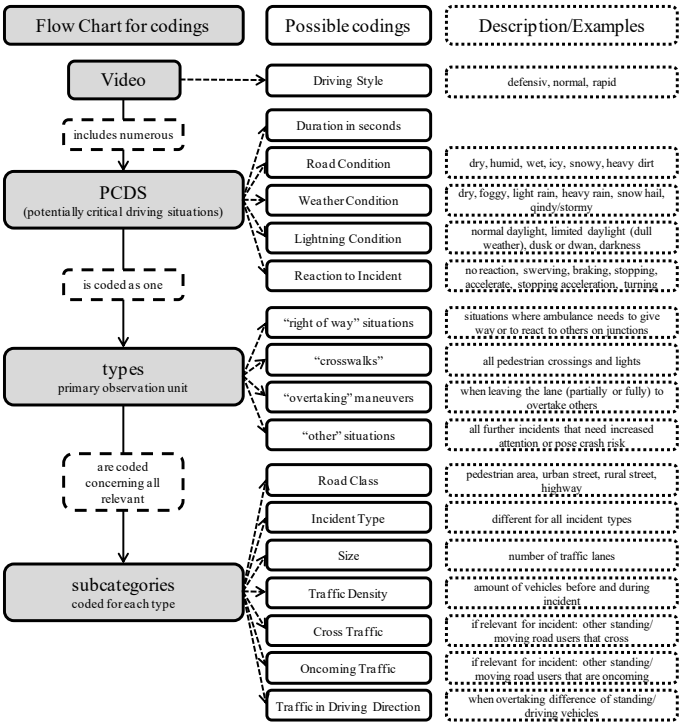

Figure 1. Flow chart of the coding process.

Statistical Analyses

Although the main goal of this study, in addition to the development of a coding protocol, was to provide an overview of the frequency of the pertinent details of PCDS and percentages and counts, we also provide χ^2 statistics from crosstabs for most categories and characteristics to give an impression of whether certain aspects differ significantly. As χ^2 statistics are difficult to interpret for crosstabs with more than two categories, χ^2 statistics for reduced crosstabs (combining all categories not in the focus of the analyses into one) are also presented. For effect sizes, phi (for 2 x 2 crosstabs) or Cramer's V (for crosstabs containing more categories) was used with the following rule of thumb for evaluation: below .20 = weak association (small effects); .20- .40 = moderate association (medium effects); and .40-.60 = relatively strong association (large effects).[19]

RESULTS

Interrater Reliability of the Final Coding

After the fourth rater evaluated all videos included in the final analysis, approximately 10% (15 videos, 108 out of a total of 1,125 minutes) were rated by a second observer (author) to ensure interrater reliability of the final coding protocol. Agreement in detected PCDS was 88.2%. The cumulative duration of 224 detected PCDS of the fourth rater was 25:08 minutes. The other rater detected 236 incidents with a cumulative duration of 24:34 minutes. A total of 29 PCDS (11.8%) were detected by only one of the raters. Of these, 16 (55.2%) were exclusively due to different lengths of the PCDS, an additional five (17.2%) were rated only by the fourth rater, and eight (27.6%) were rated only by the second observer. For the interrater reliability analyses, we used the 216 PCDS that both raters detected (see Table 2). In addition, only identically coded types were used for subcategories whose coding depends on the type (incident type, traffic density, cross traffic, oncoming traffic, traffic in driving direction). Driving style was coded once for each video.

Interrater reliability for most codes was very good (most intraclass correlation coefficients [ICC] show good to excellent agreement,[20] most Cohen's kappa coefficients almost perfect agreement[21]). Only three variables show lower

Table 2. Final interrater reliability of two raters (unit of analysis: potentially critical driving situations).

Level	Coding	n	Range	IR
PCDS	Types[b]	216	1-4	.941
PCDS	Road class[a]	216	1-4	.958
PCDS	Size[a]	216	1-3	.959
PCDS	Road condition[b]	216	1-6	.962
PCDS	Weather condition[b]	216	1-7	.837
PCDS	Lightning condition[a]	216	1-4	1.00
PCDS	Reactions to incident[b]	216	Multiple coding	.712
PCDS	Incident type[b]	209	1-9	.919
PCDS	Traffic density[a]	209	1-6	.804
PCDS	Cross traffic[a]	129	1-5	.829
PCDS	Oncoming traffic[a]	93	1-6	.649
PCDS	Traffic in driving direction[b]	75	1-2	.663
Video	Driving style[a]	15	1-3	.926

n, number of observed PCDS; *PCDS*, potentially critical driving situations; *IR*, interrater reliability depending on the data measurement scale: a=ordinal/interval data with intraclass correlation (ICC(3,1)), b=nominal data, Cohen's kappa.

interrater reliability: oncoming traffic (moderate ICC[20]) as well as reaction to incident and traffic in driving direction (both substantial kappa).[21] The moderate interrater reliability for oncoming traffic and traffic in driving direction was mostly attributable to the assessment of traffic as moving or stopping.

Overall Characteristics of PCDS

During 1,125 minutes of recorded driving with blue light and sirens, 2,048 PCDS occurred (one PCDS every 33.0 seconds). The mean duration of blue-light driving was 6.5 (range = 2-11) minutes. The median duration of PCDS was 5 seconds (mean = 6.6, range = 1-66) with no significant difference between RTV and NEF vehicles (T = 0.248, *P* = .81). Overall, 20% of the driving time involved PCDS. In 932.5 recorded minutes of RTV driving, 1,663 PCDS occurred (one PCDS every 33.6 seconds). For NEF, PCDS occurred more frequently: 385 PCDS in 192.5 recorded minutes (one every 30 seconds). The differences between vehicle type and PCDS in the time frames are significant but with a very low effect size (χ^2=6.0, *P* = .01, φ =. 010); that is, there was probably no effective difference between both vehicle types.

For most of the video recordings, a normal driving style was coded (82.0%). A total of 7.6% and 10.5% of the drivers showed a defensive or rapid driving style, respectively. The driving style was associated with the rate of PCDS occurrence. For the normal driving style, almost the same number of PCDS as the overall number was coded (one every 33.0 seconds). A defensive style was associated with a lower PCDS rate (one every 49.6 seconds), whereas a rapid driving style had a higher rate (one every 28.5 seconds).

The most frequent type of PCDS involved "right-of-way" situations (57.5%), followed by "overtaking" maneuvers (30.2%), "other" situations (8.6%). and "crosswalks" (3.7%). For RTV, the number of "right-of- way" situations was higher than for that of NEF (59.0% vs 50.9%), and for "overtaking" maneuvers, it was reversed (RTV 28.3% vs NEF 38.7%). Although this difference is significant, the effect size is very small (χ^2=16.8, *P* = .001, Cramer's V = .090). For the different driving styles, there was almost no difference between normal and rapid driving (χ^2 = 14.7, *P* = .02, Cramer's V = .060); however, a defensive driving style was associated with a higher percentage of "other" situations (15.1%), and "crosswalks" (6.6%) but fewer "overtaking" maneuvers (22.6%) (see Figure 2).

The environmental conditions were comparable for all four PCDS types (see Table 3). The streets and weather were mostly dry. Light rain and, therefore, damp streets as well as heavy rain and wet streets were also rather common. More

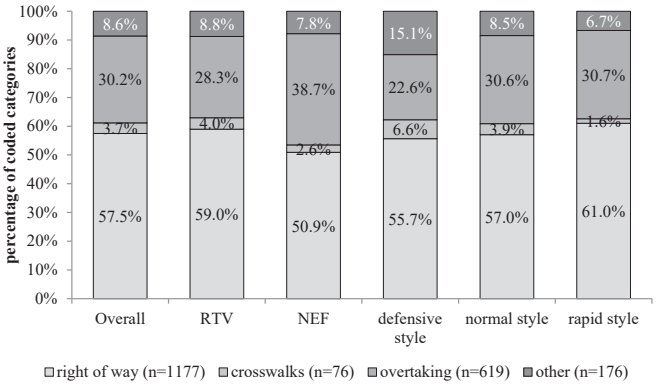

Figure 2. Overview of the PCDS types for the overall data as well as by vehicle type and driving style.
PCDS, potentially critical driving situations.

extreme weather and ground conditions were not observed in the analyzed PCDS situations. As they were present in the recordings used to develop the protocol, they are included for the sake of completeness. Approximately half of the incidents occurred during normal daylight. Some small differences can be seen in "overtaking" maneuvers where heavy rain and wet streets more often occur compared to the other PCDS. This might also explain the higher number of limited daylight (dull weather) in "overtaking" maneuvers. Darkness was found more often in "right-of-way" and "crosswalk" situations.

Most PCDS occurred on urban streets; only approximately 10% were on rural streets or highways. At first glance, this seems comparable to the number of participants who work in rural areas. However, the observed 10% PCDS on rural streets happened in approximately one third of all videos, not just in videos of participants located in rural areas. Fourteen of the videos with rural streets (23.3%) stem from participants located in rural areas, 27 videos (45%) stem from

Table 3. Environmental ground, weather and light conditions for all incident types (unit of analysis: potentially critical driving situations).

PCDS type	χ^2 (V)	Right of way (n = 1,177)	Crosswalks (n = 76)	Overtaking (n = 619)	Other (n = 176)	Overall (n = 2,048)
Ground conditions (overall χ^2 = 16.7; P = .05; Cramer's V = .052)						
dry	6.8 (.06)	797 (67.7%)	52 (68.4%)	382 (61.7%)	117 (66.5%)	1,348 (65.8%)
humid	2.9 (.04)	241 (20.5%)	20 (26.3%)	144 (23.3%)	39 (22.2%)	444 (21.7%)
wet	10.8* (.07)	125 (10.6%)	3 (3.9%)	90 (14.5%)	19 (10.8%)	237 (11.6%)
snowy	2.6 (.04)	14 (1.2%)	1 (1.3%)	3 (0.5%)	1 (0.6%)	19 (0.9%)
Weather conditions (overall χ^2 = 19.0, P = .03, Cramer's V = .056)						
dry	8.9* (.07)	1,005 (85.4%)	66 (86.8%)	496 (80.1%)	149 (84.7%)	1,716 (83.8%)
light rain	4.0 (.04)	152 (12.9%)	9 (11.8%)	100 (16.2%)	23(13.1%)	284 (13.9%)
heavy rain	13.0** (.08)	12 (1.0%)	1 (1.3%)	21 (3.3%)	3 (1.7%)	37 (1.8%)
snow	1.4 (.03)	8 (0.7%)	0 (0%)	2 (0.3%)	1 (0.6%)	11 (0.5%)
Light conditions (overall χ^2 = 61.2, P < .001, Cramer's V = .100)						
normal daylight	9.6* (.07)	584 (49.6%)	47 (61.8%)	318 (51.4%)	105 (59.7%)	1,054 (51.5%)
limited daylight	23.1** (.11)	184 (15.6%)	10 (13.2%)	151 (24.4%)	28 (15.9%)	373 (18.2%)
dusk or dawn	6.3 (.06)	65 (5.5%)	2 (2.6%)	50 (8.1%)	11 (6.3%)	128 (6.3%)
darkness	41.8** (.14)	344 (29.2%)	17 (22.4%)	100 (16.2%)	32 (18.2%)	493 (24.1%)

n=number of observed PCDS; values in brackets show the percentage over PCDS type; χ^2=chi-square with * $p \leq .05$, ** $p \leq .01$ and V=Cramer's V (in brackets): statistical different distribution across PCDS between the chosen category of condition compared to the other categories in the respective condition area combined; not observed: icy and heavily soiled ground conditions as well as foggy, hail and windy/stormy weather conditions.
PCDS, potentially critical driving situations.

participants located in suburban areas, and another 19 videos (31.7%) stem from participants located in urban areas. For the videos where all PCDS occurred just on urban streets, most participants' emergency rescue services were defined as being urban (69.6%) or suburban (25.9%); however, rural ones also occurred (4.5%). This shows that strict differentiation is not possible between regions of driving concerning potentially critical driving situations.

Characteristics of "Right of Way" Situations

Overall, 1,177 "right of way" incidents (57.5%) were coded with a mean duration of 6.4 seconds (range = 1-35). Concerning road class, most "right of way" situations occurred on urban streets (92.1%), followed by rural streets (6.5%), pedestrian areas (0.2%) and highway ramps (1.2%). The number of lanes (size) was mostly one (63.6%), followed by two (23.9%) or more than two lanes (12.6%). The majority of incident types were red lights (38.7%), junctions without signs (30.1%), and stop/yield signs (18%), followed by roundabouts (8.1%), right of way (3.1%), and yellow lights (2.1%).

The traffic density during "right-of-way" incidents was mostly quite low, which could be due to the number of lanes, the kind of street (small side streets or rural areas), or the reaction of other road users that gave the ambulance a free lane. In 77.4% of the cases, at least one lane was clear to pass other vehicles or no vehicles at all were in front of the intersections. In 20.5% of the cases, the ambulance had no problems passing either a few vehicles (16.9%) or heavy traffic (3.6%). In 2.1% of the cases, the ambulance was obstructed by either a few vehicles (0.9%) or heavy traffic (1.2%). In situations with oncoming traffic (when turning left or using most of the oncoming traffic lane) or cross traffic, there were no other road users the driver needed to pay attention to in 58.1% of the cases. However, in 19% of the cases, there were stopping/standing road users; in 14.4% at least one road user was initially moving before letting the ambulance pass; and in 8.5% of the "right-of-way" incidents at least one road user did not notice the ambulance and did not let it pass.

Characteristics of "Crosswalk" Situations

"Crosswalk" situations made up a very small number of the PCDS (76; 3.7%) and had an average duration of 2.7 seconds (range = 1-9). However, in this incident type, the most vulnerable road users were pedestrians and cyclists. Most incidents occurred on urban streets (98.7%); only one incident was on a rural street (road class). In one "crosswalk" situation, the driver had more than one lane to choose from (size). Most "crosswalk" incidents (incident types) were pedestrian crossings (92.1%), followed by red pedestrian lights (6.6%) and green pedestrian lights (1.3%). Yellow pedestrian lights did not occur during the observations.

Concerning cross traffic, there were mostly no pedestrians (84.2%), or few pedestrians who gave way to the ambulance

(15.8%). In 92.1% of the cases, no vehicles were in the lane before the "crosswalk" situation, followed by 6.6% of the cases, with few vehicles and no problems of passing (traffic density). In one case (1.3%), at least one vehicle obstructed the ambulance in front of a pedestrian crossing. For oncoming traffic, stopping drivers, initially driving and then stopping road users, and at least one driver not noticing the ambulance were each coded once (1.3%) in the "crosswalk" situations.

Characteristics of "Overtaking" Maneuvers

The 619 (30%) coded "overtaking" maneuvers were on average 5.9 sec long (range = 1-38). Compared to the other types, more incidents occurred on the road class of rural streets (15.2%) and on highways (2.3%). Nevertheless, the majority of "overtaking" maneuvers occurred on urban streets (82.4%). In most "overtaking" situations one lane (85.3%) was available, followed by two lanes (13.1%) or more than two lanes (1.6%) (size).

Concerning incident types, the situation was mostly clear (74% straight roads and 14.5% clear bends), so oncoming traffic could be evaluated by the drivers. Traffic jams occurred very rarely (0.2%). However, in 11.3% of the maneuvers, the drivers started the overtaking maneuver even though the street was obscured; therefore, the oncoming traffic could not be evaluated appropriately (4.0% unclear straight roads and 7.3% unclear bends). Most "overtaking" maneuvers had no oncoming traffic (42.6%), followed by driving (30.5%) and standing (17.6%) oncoming traffic. Figure 3 displays some situations of oncoming traffic and traffic in the driving direction by incident type (see Supplemental File C for an overview of all overtaking combinations).

Constructional separation existed in 5.8% of the "overtaking" maneuvers. Overtaking in the corridor for the emergency vehicle (1.9%) or on the right-hand side (1.5%) was very rare. Mostly 1-3 vehicles (traffic density) were overtaken (86.1%), followed by small convoys with up to nine vehicles (12.0%). Larger convoys were overtaken in 1.9% of the maneuvers. The traffic in the driving direction was 67.5% driving and 32.5% standing. Overtaking situations on unclear roads with many driving vehicles that need to be overtaken (large convoys) and driving in oncoming traffic are likely the most hazardous situations. Such situations did not occur in the coded videos. However, 0.2% of the overtaking situations were coded as overtaking of small driving convoys when traffic in the driving direction was moving in unclear bends. In one quarter (24.2%) of all "overtaking" maneuvers, traffic in the driving direction and oncoming traffic were moving.

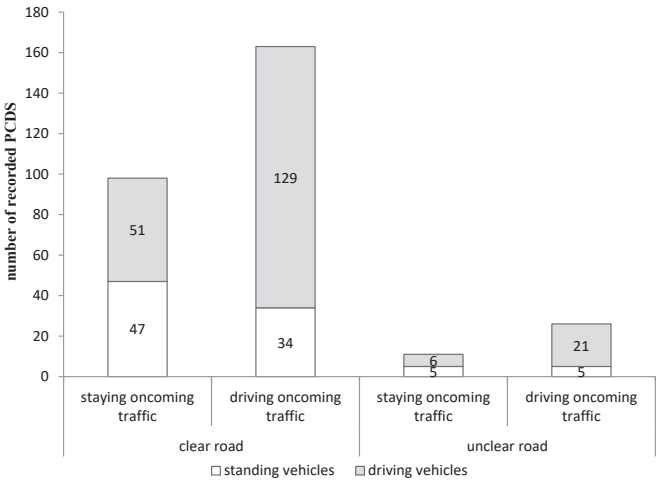

Figure 3. Extraction of overtaking maneuvers (for full data see Supplemental File C): representing oncoming traffic (bars) and traffic in driving direction (legend) depending on the clarity of the road (horizontal axis).
PCDS, potentially critical driving situations.

Characteristics of "Other" Situations

A total of 176 (8.6%) incidents were coded as "other" situations with less precisely operationalized subcategories. On average, with a duration of 11.4 seconds (range = 1-66), the situations were longer than the other types. The road class was comparable to the first two types (94.9% urban, 4% rural). However, "other" situations occurred more often on pedestrian streets (1.1%) and primarily where there was one lane (90.9%) followed by two lanes (9.1%).

Obstruction (27.3%) was the most frequent incident type within "other" situations, followed by driving the wrong way (21.6%), turning or losing the way (18.2%), and driving on a narrow road (16.5%). Lane change to specialized lanes, turfs or walkways made up 2.8% of the "other" situations. The remaining 13.6% contained other incidents, such as running children or cyclists on the street, barriers on the street, or stopping to let someone get on board. The traffic density categorization within the "other" situations showed more blocked roads than in the other types.

Characteristics of Reactions to Incidents of All Four PCDS Types

Table 4 gives an overview of the different reactions of ambulance drivers to PCDS types by driving style. Often, the drivers showed no reaction to PCDS (see Supplemental File C). Especially in crosswalk situations, incidents without reactions outnumber those with reactions. The chi-square test used to compare PDCS types and reactions shows a significant medium-sized effect (χ^2=225.0, $P < .001$, Cramer's V = .331). In 17.1% of the coded PCDS the ambulance driver showed no reaction.

This strikingly high number of no reactions in crosswalk situations (63.2%) might be due to the high number of no vehicles in front of crosswalks (92.1%) and no pedestrians on them (84.2%). In four situations with no reaction, there were a few pedestrians that let the ambulance pass; in all other situations there were no other road users. The differences between driving styles and reactions in the "crosswalk" situations are not significant.

Table 4. Reactions to PCDS by ambulance drivers depending on the driving style and PCDS types (unit of analysis: PCDS)

PCDS	Driving Style	χ² (V)	Reactions to PCDS						
			no reaction	swerving	braking	swerving and braking	stopping	stopping acceleration	mixed (swerving, braking, stopping, and/or turning)
Right of way (n = 1,177)	**χ² (V)**	52.9** (.15)	18.1** (.12)	18.0** (.12)	15.9** (.12)	5.9 (.07)	2.0 (.04)	0.2 (.01)	0.4 (.02)
	defensive driving style (n = 59)	5.1 (.07)	15 (25.4%)	0 (0%)	41 (69.5%)	3 (5.1%)	0 (0%)	0 (0%)	0 (0%)
	normal driving style (n = 963)	35.4** (.17)	195 (20.2%)	14 (1.5%)	620 (64.4%)	118 (12.3%)	9 (0.9%)	1 (0.1%)	6 (0.6%)
	rapid driving style (n = 155)	47.9** (.20)	55 (35.5%)	10 (6.5%)	75 (48.4%)	11 (7.1%)	3 (1.9%)	0 (0%)	1 (0.6%)
Crosswalks (n = 76)	**χ² (V)**	2.2 (.12)	2.1 (.16)	-	1.4 (.14)	0.5 (.08)	-	-	-
	defensive driving style (n = 7)	1.7. (.15)	6 (85.7%)	0 (0%)	1 (14.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	normal driving style (n = 65)	2.1 (.17)	39 (60.0%)	0 (0%)	23 (35.4%)	3 (4.6%)	0 (0%)	0 (0%)	0 (0%)
	rapid driving style (n= 4)	0.3 (.07)	3 (75.0%)	0 (0%)	1 (25.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Overtaking (n = 619)	**χ² (V)**	29.1** (.15)	4.7 (.09)	22.7** (.19)	2.2 (.06)	13.1** (.15)	0.2 (.02)	-	0.4 (.03)
	defensive driving style (n = 24)	4.9 (.09)	0 (0%)	11 (45.8%)	0 (0%)	13 (54.2%)	0 (0%)	0 (0%)	0 (0%)
	normal driving style (n = 517)	25.5** (.20)	23 (4.4%)	141 (27.3%)	43 (8.3%)	305 (59.0%)	1 (0.2%)	0 (0%)	4 (0.8%)
	rapid driving style (n = 78)	23.0** (.19)	0 (0%)	41 (52.6%)	7 (9.0%)	29 (37.2%)	0 (0%)	0 (0%)	1 (1.3%)
Other (n = 176)	**χ² (V)**	51.7** (.38)	6.5* (.19)	0.9 (.07)	4.2 (.16)	4.2 (.16)	4.8 (.17)	9.4** (.23)	12.8** (.27)
	defensive driving style (n = 16)	26.5** (.39)	0 (0%)	0 (0%)	7 (43.8%)	1 (6.3%)	0 (0%)	0 (0%)	8 (50.0%)
	normal driving style (n = 143)	20.8* (.34)	11 (7.7%)	4 (2.8%)	62 (43.4%)	12 (8.4%)	33 (23.1%)	0 (0%)	21 (14.7%)
	rapid driving style (n = 17)	26.2** (.39)	4 (23.5%)	0 (0%)	3 (17.6%)	4 (23.5%)	3 (17.6%)	1 (5.9%)	2 (11.8%)
Overall (N = 2,048)	**χ² (V)**	101.3** (.16)	11.9** (.08)	26.1** (.11)	10.3** (.07)	13.1** (.08)	2.8 (.04)	2.6 (.04)	16.2** (.09)
	defensive driving style (n = 106)	51.4** (.16)	21 (19.8%)	11 (10.4%)	49 (46.2%)	17 (16.0%)	0 (0%)	0 (0%)	8 (7.5%)
	normal driving style (n = 1,688)	51.1** (.16)	268 (15.9%)	159 (9.4%)	748 (44.3%)	438 (25.9%)	43 (2.5%)	1 (0.1%)	31 (1.8%)
	rapid driving style (n = 254)	49.7** (.16)	62 (24.4%)	51 (20.0%)	86 (33.8%)	44 (17.3%)	6 (2.4%)	1 (0.4%)	4 (1.6%)

n=number of observed PCDS, % in brackets = percentage over the driving styles; χ²=chi-square with * p ≤ .05, ** p ≤ .01 and V=Cramer's V (in brackets): χ² in column = statistical differences between the chosen driving style compared to the other two driving styles combined over the reactions to PCDS; χ² in rows = statistical differences between the respective reaction against all other reactions combined over the driving style; χ² in italics report the overall result for 3*7 crosstabs.
PCDS, potentially critical driving situations.

The high number of no reactions in the "right-of-way" situations (22.5%) might be explained (at least in part) by the fact that often no or few other road users obstructed the ambulance. However, when looking at the other subcategories combined, in four cases there was moving cross traffic but no reaction to it. At 27 red lights (10.1%), 56 stop/yield signs (21.1%), and 138 intersections without a sign (52.0%), the ambulance driver continued to drive as before. These PCDS might rapidly change into critical situations or even (near) crashes. The rapid driving style showed a higher number of no reactions and swerving but a lower number of braking behaviors compared to the other two driving styles.

For the "overtaking" maneuvers in PCDS, a much lower number of no reactions were found, which was due to the higher number of swerving with or without braking. These reactions show significant differences with small- to medium-effect sizes between the different driving styles, namely, more swerving for drivers with a rapid driving style and more serving combined with braking for normal driving style.

The reactions to "other" situations vary much more due to the mix of situations that are summed up in this type. No reaction to "other" situations was mostly present in the rapid driving style, followed by the normal driving style. In one of those situations, vehicles were in front of the ambulance, and in three other cases, there were initially driving/moving road users in crossing or oncoming traffic that let the ambulance pass. These cases might have easily ended in more critical driving situations if the other road users had not reacted as properly as they did. The defensive driving style shows a high number of a mix of different reactions to the PCDS. This effect has a medium-effect size.

DISCUSSION

In this study we aimed to establish an objective protocol for the video analysis of emergency driving situations and to describe these situations in detail. We successfully developed a detailed and extensive coding protocol with good-to-excellent interrater reliability for most assessed codes and analyzed a large amount (1,125 minutes) of driving with blue light and sirens in actual traffic in urban and rural areas. Moreover, as 71 drivers from different parts of Germany and different rescue services with a wide range of working and driving experience were included, our data provides a broad picture of traffic safety while driving with emergency light and sirens. They show how often drivers need to pay greater attention to traffic due to the necessity of stretching or disregarding traffic regulations, or to react to traffic in some other way.

Overall, 2,048 PCDS occurred, that is, one PCDS every 33 seconds of driving with blue light and sirens. This is less frequent than that previously found but is still a very common event. Twenty percent of the driving time involved PCDS. During an average blue-light run of approximately seven minutes, the driver had to deal with more than 12 PCDS. This is a much higher number of potentially critical incidents than "real" incidents found in general by other researchers who used triggers and detected one incident every 350 kilometers or every five hours.[12]

We showed the high potential for critical situations and crashes. The PCDS found in this study can easily precede crashes or near-crashes if minor circumstances change, such as one car of an overtaken convoy pulling out or a road user not noticing the ambulance. In line with this reasoning, more than half of the PCDS occurred during "right-of-way" situations where the ambulance driver mostly needed to deal with a red light, or an intersection without any signs or a stop/yield sign. Another 30% of the PCDS were overtaking maneuvers. Intersection and overtaking events are situations with the highest crash risk for driving with blue light and sirens.[3,4,6] Crosswalk-related PCDS were rather rare; however, they bear a high risk for the most vulnerable groups in traffic – pedestrians and in particular children – who cannot evaluate vehicles' speed.

Road users in general were considered in three subcategories, namely, traffic density, crossing and oncoming traffic, and, for overtaking maneuvers, traffic in the driving direction. In most PCDS, there were no or few other road users involved, and these mostly did not hinder the ambulance. The reasons for this might be the number of lanes, allowing for at least one free lane when other road users reacted correctly to the ambulance. Additionally, specialized lanes often lead to a free space to drive through an intersection. A blocked road or a road user continuing to drive/walk without letting the ambulance pass (8.6% of the cases) does not necessarily mean that the respective drivers did not react correctly: it could also be that there was no space to get out of the way.

This data suggests that most road users acted correctly or at least attempted to cede the right of way to the ambulance as they were supposed to do. One reason for the correct reaction of other road users might have been an early start of the blue light and siren by the ambulance drivers (which was not recorded). The earlier the signals are activated, the more time other road users have to free the way and, even more importantly, orient themselves in the situation to cede the right of way in a controlled manner without endangering themselves or other road users. However, these are assumptions from the rather small number of coded involvement of others even on urban streets, as other road users were not directly observed. Nevertheless, this is a particularly important point concerning the training of ambulance drivers. This suggests not only that other road users often at least try to act correctly and give way to the ambulance but also shows the potential high impact of the ambulance drivers' correct (or incorrect) behavior in the situation.

Against this background, we also analyzed the reactions of emergency vehicle drivers to PCDS. Most often, the drivers braked and/or swerved due to the PCDS. However, in more than one fifth of the "right-of-way" situations and even two

thirds of the "crosswalk" situations, the driver did not react to the PCDS at all and continued driving as before. In those situations, a crash can easily happen due to a misinterpretation of the behavior by other road users or inattentiveness due to other distracting tasks, such as thinking of the upcoming operation or using radio communication. Evasive maneuvers have been found to play a role in crash prevention, which shows the importance of reacting correctly to PCDS.[14]

Independent of the behavior prior to incidents, such as correct use of directional signaling, early use of warning lights and sirens or adequate speed and distance, the reaction to an incident is important to address in driver training classes. Each swerving requires space that needs to be considered. Joint braking and swerving produces high forces on the ambulance vehicle. No reaction at all can easily lead to critical driving situations. Crashes without reactions beforehand might end up with legal consequences. However, reactions that might confuse other road users, such as stopping at intersections despite other road users having noticed the ambulance, might also lead to uncontrolled reactions of others and to critical situations. Thus, the reactions to incidents while driving with warning lights and sirens should be part of practical or at least simulated training of ambulance drivers.

Finally, the driving style itself plays a role. For the rapid driving style, a higher number of PCDS was found, and for "right-of-way" and "other" situations, drivers with a rapid driving style often showed significantly more lack of reaction to the PCDS. In "overtaking" maneuvers, ambulance drivers with a rapid driving style more often reacted by swerving without braking, whereas those with normal driving style more often reacted with swerving and braking together. The defensive driving style was shown in "other" situations, often a mix of different reactions. Although it makes sense that a more rapid driving style would lead to more PCDS per minute and a more defensive driving style would lead to a lower rate, the reverse could also be true: the raters might have given their general impression of the driving style based on the number of PCDS they observed.

LIMITATIONS

In addition to this potential confounding matter of how raters may have judged the driving style of emergency responders, our study has additional limitations that should be considered. Information on the initial speed when assessing the reaction to the PCDS was missing, and other road users were not coded. Although the coding protocol was developed with several raters, just one rater observed all videos. To reduce possible systematic coding mistakes, this rater was instructed in detail, some videos were double-checked, and difficult situations were discussed. The agreement on detected incidents found in the final interrater reliability still has potential for improvement. The relatively lower agreement for the codes "oncoming traffic" and "traffic in driving direction" could have different reasons. One is that it was often difficult to determine whether vehicles were stopping or driving on the video especially if the other drivers recognized the ambulance and decelerated. If they were almost stopped it could be that raters differently assessed this situation. Another reason could be the different lengths of the incidents, especially the "overtaking" maneuvers.

However, the rater who had the lower number of detected incidents rated all videos; this suggests an underestimation of actual PCDS. The effort required to evaluate the videos is large (up to eight times the video time), so only a smaller portion of videos, but a substantially larger amount than in previous research, was analyzed. Therefore, it cannot be excluded that the analysis of more videos would change the results. However, due to the random selection of the evaluated videos and the wide range of included drivers, we are confident that the key messages would not change. It would be an interesting addition to use artificial intelligence to enable automated video evaluation for at least parts of the observation protocol to be able to evaluate a much larger number of videos.

The sample consists of volunteer participants who knew they were part of a study and might, therefore, have driven less dangerously or aggressively. However, the participants were measured numerous times, which might have led to habituation to the situation of being observed, and the analyzed videos were drawn randomly. Moreover, a rather large sample in terms of analyzed time and drivers of various backgrounds participated, so we are cautiously confident that the data is generalizable to regions with comparable traffic and legal regulations for driving with warning lights and sirens. However, it must be considered that regulations for training programs vary between countries even within the European Union.[22] Nevertheless, as we included experienced and inexperienced drivers with different licenses, and different working and driving experience the general direction of the data will likely hold true.

CONCLUSION

This study presents a unique overview of potentially critical driving situations while driving with emergency lights. The risk of a PCDS evolving into a critical situation or crash is high but has not been quantified. Although they occur less often than previously reported, PCDS still make up 20% of the driving time. Typical PCDS situations as well as those that are less frequent but pose a high risk can be used for educational programs. Ambulance drivers should become more aware of those typical – usually not interpreted as risky – situations and learn how to manage them to increase the traffic safety of emergency response driving. Although a number of PCDS are dependent on other road users' reactions, ambulance drivers continue to have the highest impact on traffic safety while driving with warning lights and sirens. Traffic safety training should, therefore, be the content of education and training of all emergency

medical personnel driving ambulances. The PCDS and issues found in this study can be used as examples and starting points in such trainings to raise awareness for critical situations and their common occurrence, and to discuss and train for their prevention and adequate responses. This might help to support a mutual understanding between ambulance drivers and other road users.

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Application of Point-of-care Ultrasound for Screening Climbers at High Altitude for Pulmonary B-lines

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Introduction: High-altitude pulmonary edema (HAPE) occurs as a result of rapid ascent to altitude faster than the acclimatization processes of the body. Symptoms can begin at an elevation of 2,500 meters above sea level. Our objective in this study was to determine the prevalence and trend of developing B-lines at 2,745 meters above sea level among healthy visitors over four consecutive days.

Methods: We performed a prospective case series on healthy volunteers at Mammoth Mountain, CA, USA. Subjects underwent pulmonary ultrasound for B-lines over four consecutive days.

Results: We enrolled 21 male and 21 female participants. There was an increase in the sum of B-lines at both lung bases from day 1 to day 3, with a subsequent decrease from day 3 to day 4 (P<0.001). By the third day at altitude, B-lines were detectable at base of lungs of all participants. Similarly, B-lines increased at apex of lungs from day 1 to day 3 and decreased on day 4 (P=0.004).

Conclusion: By the third day at 2,745 meters altitude, B-lines were detectable in the bases of both lungs of all healthy participants in our study. We assume that increasing the number of B-lines could be considered an early sign of HAPE. Point-of-care ultrasound could be used to detect and monitor B-lines at altitude to facilitate early detection of HAPE, regardless of pre-existing risk factors.
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INTRODUCTION

High-altitude illness (HAI) is a spectrum of pathology including acute mountain sickness, high-altitude cerebral edema, and high-altitude pulmonary edema (HAPE).[1,2] Illness occurs due to acute ascent to altitude faster than the acclimatization processes of the body.[3-5] High-altitude illness generally begins at an elevation of 2,500 meters above sea level.[3-5] The most life-threatening form of HAI is HAPE,

which is the result of an abnormal development of fluid within the lungs. High-altitude pulmonary edema typically occurs after rapid accent to altitudes greater than 2,500 meters above sea level.[6] Symptoms can range from fatigue, nonproductive cough, and dyspnea on exertion to more severe manifestations, which may include frothy sputum production and even respiratory distress.[3,7]

The use of point-of-care ultrasound (POCUS) in evaluating interstitial edema has been shown to be highly sensitive and specific for the evaluation of both cardiac and non-cardiac pulmonary edema.[8-12] Previous studies have also shown an association between geographical elevation and the development of non-cardiac pulmonary edema on ultrasound through identification of B-lines (previously "comet tails").[13-15] Advances in portability and the reduced cost of POCUS units have introduced an opportunity for its application in screening for subclinical interstitial edema at altitude. Our objective in this study was to determine the prevalence and trend of developing B-lines at 2,745 meters above sea level among healthy visitors over four consecutive days.

Population Health Research Capsule

What do we already know about this issue?
High-altitude pulmonary edema (HAPE) can occur at 2,500 meters altitude. The treatment is descent, which can be important to plan for in resource-limited settings.

What was the research question?
Our goal was to find the trend of developing B-lines at 2,745 meters above sea level among healthy visitors over four consecutive days.

What was the major finding of the study?
Major comparison with P-value and confidence interval
The median number of B-lines at the bases of both lungs rose from zero in day 1 to three in day 3 and then dropped to two in day 4 ($P<0.001$).

How does this improve population health?
Point-of-care ultrasound can be used to detect early stages of HAPE in asymptomatic climbers. Early detection affords the opportunity for timely intervention.

METHODS

Study Setting and Population

We performed a prospective case series using a convenience sample of healthy volunteers between March 4-7, 2019. Subjects were recruited at Mammoth Mountain, CA, where they presented for an educational conference. The site of enrollment was the base of Mammoth Mountain, which is approximately 2,745 meters above sea level. Inclusion criteria were as follows: being older than 18 years; arriving from sea level prior to arrival at the mountain; and planning to present at altitude for at least four days. Exclusion criteria included pregnancy, presence at 1,500 meters altitude or higher at any point within 14 days of study enrollment, a history of pulmonary edema, lung cancer, congestive heart failure, pulmonary hypertension, pulmonary embolism, chronic obstructive pulmonary disease, and/or pneumonia or influenza within 30 days.

All subjects were approached at Mammoth Mountain within 24 hours of arrival and given a study information sheet explaining the purpose of the study. Both verbal and written consent was obtained. The study was approved by the local institutional review board.

Data Collection

Subjects were given a data collection sheet and asked to report age, gender, medical history, and history of chest trauma. A POCUS was performed on subjects using a Mindray TE7 (Mindray Corp, Shenzhen, China) ultrasound machine with a phased-array 2-5 megahertz transducer in the pulmonary setting. Subjects were scanned in a seated, upright position in the sagittal orientation.

All pulmonary scans consisted of four lung ultrasound images (windows): one mid-clavicular scan at the third intercostal space (apical) of each hemithorax, as well as one posterior-axillary scan at the fourth/fifth intercostal space (base) of each hemithorax (right and left). We counted and recorded the number of B-lines visualized within a single, four-second video clip lung window. Subjects were re-scanned at 24-hour intervals over the course of four consecutive days in the exact same location. Images were obtained by two ultrasound- fellowship trained emergency physicians under supervision of the principal investigator. We summed up the total number of B-lines at the bases of both lungs and observed the change of this discrete variable across days. We also summed up the total B-lines at the apical lung fields of both lungs and reported the change of this discrete variable over the time.

Statistical Analysis

We performed statistical analysis using SPSS Statistics for Windows, version 23.0 (IBM Corp, Armonk, NY). Age is reported as mean, standard deviation (SD) and median. The sum of B-lines at the bases of both lungs, and also the sum of B-lines at the apexes of lungs are reported as median and interquartile range (IQR). We used Friedman's test to determine the statistical significance of change in the sum number of B-lines over the four-day time frame, considering the repeated measure structure of data. We used Pearson's chi

square test to compare proportion of subjects with zero B-lines across days. Type I error level was set to 0.05.

RESULTS

We enrolled 21 (50%) male participants with the mean age of 35.8 (SD 10.66, median 33) and 21 (50%) female participants with the mean age of 43.4 (SD 13.74, median 40). Figures 1 and 2 illustrate the distribution of the sum of B-lines at the base and apex of both of each subject's lungs, respectively. The percentage of patients with zero B-lines in the bases of both lungs decreased from 67% to 3% to 0% within the first three days of the study (Figure 1) ($P< 0.001$). In contrast, the percentage of participants with B-lines in all other B-line categories (1-2, 3-4 and >4) increased within the first three days of the study ($P< 0.001$). On day 4, there was a decrease in the percentage of subjects with B-lines >0 ($P=0.02$). The median number of B-lines at the bases of both lungs rose from zero (IQR 0-0) in day 1 to three (IQR 2-4) in day 3 and then dropped to two (IQR 1-3) in day 4. The change in sum of B-lines at the lung bases was statistically significant ($P<0.001$).

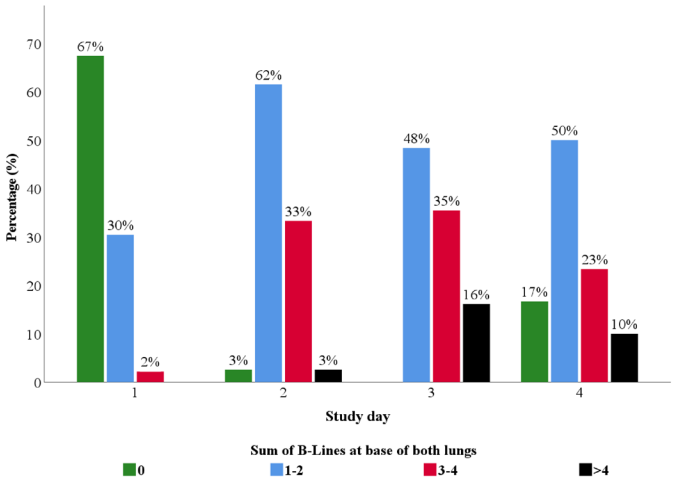

Figure 1. Distribution of the sum of B-lines at the base of both lungs over four days at altitude.

The change in the apical lung fields over time was similar to those observed in the lung bases (Figure 2). There was an increase in the sum of B-lines at both lung apices from day 1 to day 3, with a decrease from day 3 to day 4. The percentage of patients with no B-lines in the lung apices decreased from 85% to 67% to 35% within the first three days of the study ($P< 0.001$). The percentage of patients with 1-2 B-lines increased from 15% in day 1 to 55% on day 3 and then decreased to 20% by day 4 ($P=0.001$). Again, the percentage of participants with no B-lines did increase after 72 hours at altitude from 35% to 77% ($P=0.001$). The median number of

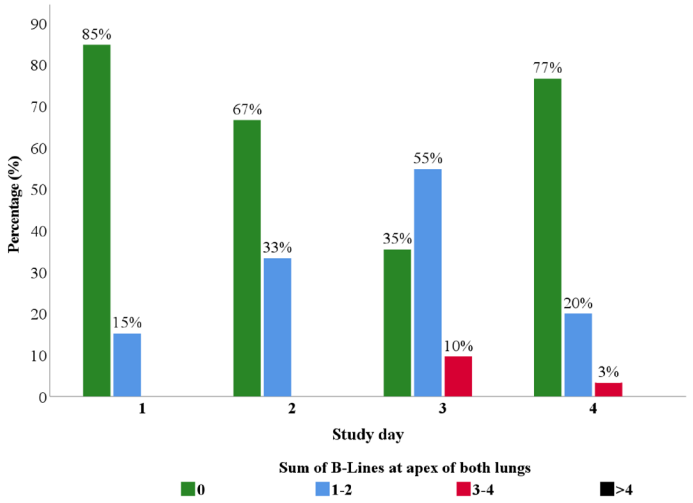

Figure 2. Distribution of the sum of B-lines at the anterior apex of both lungs over four days at altitude.

B-lines at the apical fields of both lungs rose from zero (IQR 0-0) in day 1 to one (IQR 0-2) in day 3 and then dropped to zero (IQR 0-0) in day 4. The change in sum of B-lines at the apical lung fields was statistically significant ($P=0.004$).

DISCUSSION

The objective of our study was to find out the potential application of POCUS in early detection of HAPE and to identify the prevalence and trend of B-lines among healthy climbers. We detected B-lines at the bases of the lungs of all subjects by the third day at altitude. The participants were healthy volunteers with no pre-existing symptoms or related medical conditions. This indicates that POCUS could be considered for screening HAPE even if there is no significant risk factor. We did not intend to determine what percentage of participants ultimately developed clinical HAPE, but we assume increasing number of B-lines could be considered an early sign of HAPE.

Early detection of HAPE is important especially before dark when transportation becomes difficult. High-altitude pulmonary edema can occur at 2,500 meters altitude. Risk factors for HAPE include rapid ascent, higher altitude, and prior development of HAPE.[6,17,19] Our data illustrates a peak in the number of B-lines at 72 hours, which also coincides with the expected presentation timeline of HAPE. On day 4, the decline in the number of B-lines within both lung locations may have occurred in the setting of acclimatization.

We attempted to control for some sources of variance in the B-lines as follows: By excluding pre-existing pulmonary conditions or infectious symptoms prior to enrollment, we controlled for any factors or pathology outside those caused by changes in altitude. We also considered the possibility of trauma as a cause for B-lines. Pulmonary contusions, as the result of direct/indirect mechanical trauma, have been shown

to cause isolated B-lines on pulmonary ultrasound[16]; thus, monitoring B-lines in climbers with chest trauma may be another application of POCUS at altitude.

We did not evaluate the relationship between development of B-lines at altitude and clinical HAPE. Prior studies have defined clinical, non-cardiogenic pulmonary edema in the setting of HAPE by a B-line score.[10] Yang et al reported sensitivity and specificity of pulmonary ultrasound for HAPE as 98.4% and 90.9%, respectively.[10] Future large-scale studies are needed to determine whether POCUS can be used as a method of predicting which individuals will potentially develop life-threatening pulmonary edema at altitude.

LIMITATIONS

Our sampling strategy and exclusion criteria limit generalizability to a young and healthy population. Many participants spent recreational time performing physically demanding activities such as skiing or snowboarding. The intensity of activity required for skiing or snowboarding generally predicts a certain level of cardiopulmonary fitness. Future large-scale studies are needed to determine whether the observed trends in B-lines exist or become more exaggerated under higher altitude conditions. Additionally, many factors were self-reported in data collection and could not be validated.

CONCLUSION

By the third day at 2,745 meters altitude, B-lines were detectable in the bases of lungs of all healthy participants in our study. Point-of-care ultrasound could be used to detect and monitor B-lines at altitude to facilitate early detection of high-altitude pulmonary edema, regardless of pre-existing risk factors. The importance of these findings and the relationship with further development of altitude illness is yet to be studied.

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Care of Bullet-related Injuries: A Cross-sectional Study of Instructions and Prescriptions Provided on Discharge from the Emergency Department

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Introduction: There are more than 80,000 emergency department (ED) visits for non-fatal bullet- related injuries (BRI) per year in the United States. Approximately half of these patients are discharged home from the ED. Our objective in this study was to characterize the discharge instructions, prescriptions, and follow-up plans provided to patients discharged from the ED after BRI.

Methods: This was a single-center, cross-sectional study of the first 100 consecutive patients who presented to an urban, academic, Level I trauma center ED with an acute BRI beginning on January 1, 2020. We queried the electronic health record for patient demographics, insurance status, cause of injury, hospital arrival and discharge timestamps, discharge prescriptions, and documented instructions regarding wound care, pain management, and follow-up plans. We analyzed data using descriptive statistics and chi-square tests.

Results: During the study period, 100 patients presented to the ED with an acute firearm injury. Patients were predominantly young (median age 29, interquartile range 23-38 years), male (86%), Black (85%), non-Hispanic (98%), and uninsured (70%). We found that 12% of patients did not receive any type of written wound care instruction, while 37% received discharge paperwork that included instructions to take both an NSAID and acetaminophen. Fifty-one percent of patients received an opioid prescription, with a range from 3-42 tablets (median 10 tablets). The proportion of patients receiving an opioid prescription was significantly higher among White patients (77%) than among Black patients (47%).

Conclusion: There is variability in prescriptions and instructions provided to survivors of bullet injuries upon ED discharge at our institution. Our data indicates that standardized discharge protocols could improve quality of care and equity in the treatment of patients who have survived a BRI. Current variable quality in discharge planning is an entry point for structural racism and disparity. [West J Emerg Med. 2023;24(2)363–367.]

INTRODUCTION

Bullet-related injuries (BRI) are a public health epidemic. The United States (US) averages more than 85,000 annual emergency department (ED) visits for non-fatal bullet injury.[1] While some BRI patients will be admitted to the hospital for further management, approximately 70% are discharged from the ED to self-care and outpatient management.[1]

Patients who survive a BRI are at a vulnerable and

complex moment in their lives.[2] Many BRI patients are young, uninsured, and likely to be individuals who are otherwise healthy without regular contact with the healthcare system.[3,4] This places additional burden on these patients who must manage the physical pain and emotional distress of having survived a BRI, and then learn how to care for their injury without prior wound care experience.[5] This can create a challenging and traumatic recovery for many patients.

St. Louis, Missouri, has one of the highest rates of murder and violent crime per capita in the US, with the rate of violent firearm deaths over 14 times the national average in 2016.[6,7] Our institution cares for over 600 patients with BRI per year.[3] Our prior work found that 26% of patients discharged from our ED return within 12 months with a chief complaint most frequently related to pain or wound concerns.[8] Given this high return rate, we investigated the anticipatory guidance and clinical resources that BRI patients receive on discharge from our institution.

Our primary objective in this study was to analyze the wound care instructions and pain management plans provided to BRI patients on discharge from the ED. We also characterize the follow-up plans and resources given to BRI patients upon their discharge from the ED. Racial minorities frequently experience health disparities in our region, and our preliminary data indicate that 86% of individuals injured by firearms in our region are Black.[9] For this reason, we also performed a preliminary investigation of differences in care based on patient race.

METHODS

Study Design

This was a single-center, cross-sectional needs assessment study of a convenience sample of the first 100 consecutive patients who presented to the ED with an acute BRI in 2020. This needs-assessment study is part of a larger ED initiative to improve trauma-informed care in the ED. Patients included in this study presented to the ED between January 1–April 19, 2020. Findings are reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[10] This study was approved by our institutional review board.

Study Setting and Population

This urban, academic, Level I trauma center ED with over 90,000 annual patient visits is part of the Washington University healthcare system that serves St. Louis, MO, which has a high incidence of BRI.[3,7] The care of firearm-injured patients in this ED is provided by a team of over 200 clinicians including attending physicians, residents, and advanced practice practitioners.

Study Protocol

We identified patients by mapping *International Classification of Diseases, 10th Revision,* acute firearm-injury codes to SNOMED software (SNOMED International, London, United Kingdom, https://www.snomed.org/snomed-international/who-we-are). The search was accomplished using SNOMED terms in Table 1 and all descendent terms in the SNOMED hierarchies used in clinical documentation and reporting. The resultant full list of SNOMED terms is included in Appendix A.

Table 1. Terms for bullet-related injuries from the SNOMED collection of clinical terms.

eSNOMED ID	SNOMED Term
219335006	Handgun
219337003	Hunting rifle
219338008	Military firearm
219336007	Shotgun
219257002	Legal intervention
283545005	GSW
243000002	Injury due to bullet

GSW, gunshot wound.

This was a study of consecutive, adult patients (≥18 years old) who presented to the ED for care after sustaining an acute BRI. We excluded from analysis those patient visits related to follow-up care after a prior injury. Author JMH extracted study data through query of the electronic health (EHR). The EHR patient chart was manually reviewed for patient demographic information, emergency clinician notes, any new prescriptions that were ordered on discharge, and the full set of written instructions that were printed for the patient upon discharge.

Measurements

We collected data on the following variables: age; gender (as a biologic variable); race and ethnicity (as a marker of underlying structural inequities); insurance status; cause of injury; hospital arrival and discharge timestamps; prescriptions provided on discharge; and instructions provided to patients in their printed discharge paperwork. We recorded patients' length of stay in the ED based on the EHR timestamp from arrival for acute BRI to timestamp for discharge. We also collected data on whether patients received written wound care discharge instructions, and whether there was clinician documentation of provision of any type of wound care supplies (gauze, bacitracin, etc.).

We queried discharge instructions for written instructions regarding types of pain management provided. This included the frequency that the discharge instructions referenced over-the-counter pain medications such as non-steroidal anti-inflammatory drugs (NSAID) (ie, ibuprofen, naproxen), acetaminophen, topical therapies (ie, lidocaine patches), and non-pharmacologic options (ie, ice therapy, heat therapy, elevation, etc). We documented any new prescriptions that patients received for pain management, such as NSAIDs, acetaminophen, muscle relaxants, topical therapies, and

opioids. We examined the type of opioid prescriptions and tablet counts that were prescribed and calculated the prevalence of receiving an opioid prescription at discharge based on patient race.

Query of written, follow-up instructions included analysis of outpatient follow-up care locations provided to patients in writing at discharge. This included instructions to follow up with an established primary care doctor, establish care with a new primary care doctor, follow up with a general surgery wound care clinic, or follow up with a subspecialty surgical clinic.

Data Analysis

We summarized demographic and clinical characteristics using descriptive statistics in the form of median (interquartile range [IQR]) for continuous variables and frequency (percentage) for categorical variables. Chi-square tests were used to compare the number of opioid prescriptions provided by patient race. We conducted all analyses using Stata statistical software version 16 (StataCorp, LLC, College Station, TX).

RESULTS

There were 100 patients who presented to the ED with an acute BRI between January 1–April 29, 2020. Patients were predominantly young (median age 29 years old, IQR 23-38), male (86%), Black (85%), non-Hispanic (98%), and uninsured (70%). The primary attributed cause of the BRI was interpersonal violence (83%). Patient demographics are detailed in Table 2. Patients spent a mean of five hours (SD 3.51) in the ED from time of arrival to time of discharge. We found that 12% of patients did not receive any type of written wound care instructions. There was not any significant racial variation in the prevalence of instruction. Only two patients were documented as having received any type of wound care supplies to take home to help with the initial dressing changes.

Additionally, we found that 71% of patients received instructions to take an NSAID and 41% received instructions to take acetaminophen, while 37% of patients received instructions to take both an NSAID and acetaminophen. Comprehensive description of pain medication, written instructions, and counts of new pain medications prescribed at time of discharge are detailed in Table 2. There was variability among opioid prescription rates. The median number of opioid tablets prescribed at discharge was 10 tablets, which ranged from 3-42 tablets. The proportion of patients receiving an opioid prescription was significantly higher (P=0.05) among White patients (77%) than among Black patients (47%).

Regarding follow-up plans, 13% of patients did not receive any type of written instructions for a follow-up location. There was not any significant racial variation in the prevalence of instruction to seek follow-up care. Some patients were instructed to follow up at either a surgical wound care (34%) or subspecialty clinic (34%). While some

Table 2. Demographics, injury characteristics, and discharge pain medications provided to 100 patients discharged from the emergency department after bullet-related injury.

	Count & %
Age in years (Median, IQR)	29 (23-38)
Race	
Black	85
White	13
Asian	1
Not specified	1
Gender	
Male	86
Female	14
Cause of injury	
Interpersonal violence	83
Accidental	14
Self-inflicted	1
Not specified	2
Insurance	
Self-pay	70
Private	15
Medicare	1
Medicaid	14
Instructions referenced*	
Acetaminophen	41
NSAIDs	71
Muscle relaxants	0
Topical therapies	3
Opioids	49
Non-pharmacologic therapies	59
Prescribed at discharge**	
Acetaminophen	25
NSAIDs	39
Muscle relaxants	0
Topical therapies	2
Gabapentin	2
Opioids	51
Morphine 15 mg	8 (16%)
Morphine 30 mg	4 (8%)
Oxycodone 5 mg	14 (27%)
Hydrocodone-acetaminophen 5-325 mg	20 (39%)
Oxycodone-acetaminophen 5-325 mg	4 (8%)
Tramadol 50 mg	1 (2%)

*Some patients received instructions about more than one medication.
**Some patients received a prescription for more than one medication.
IQR, interquartile range; *NSAIDs,* non-steroidal anti-inflammatory drugs; *mg,* milligram.

patients (28%) were instructed to follow up with a primary care physician, only four of these patients (14%) had a previously established primary care physician.

DISCUSSION

The results of this study reveal that our institution provides variable discharge instructions and resources to BRI survivors upon ED discharge. This included inconsistencies in both the presence and quality of written wound care instructions, as well as in whether pain medications were recommended, explained, or prescribed. As our institution does not have a standard discharge pathway, it is possible that patients received inconsistent instructions based on clinicians' preferences, style, and oversight.

We found substantial variability in the type and quantity of pain medications prescribed on discharge. The median number of opioid tablets prescribed at discharge was 10 tablets, which ranged from 3-42 tablets. We also noted racial disparity in the proportion of patients receiving an opioid prescription (77% in White patients vs 47% in Black patients). Our findings support prior work that found non-Hispanic Blacks were less likely to receive an opioid prescription for back and abdominal pain upon ED discharge.[11] Other studies have found that Black children are less likely than other racial groups to receive an opioid medication in the ED for conditions ranging from bone fractures to appendicitis.[12,13]

It is imperative for EDs to provide appropriate resources and anticipatory guidance to BRI survivors at the time of discharge. In response to these findings, we are in the process of developing a discharge smart-set in the EHR to improve standardization of discharge care in BRI survivors. Every patient who survives an acute BRI should at the very least have clear instructions about their wound care and a realistic plan for follow-up. We recognize that as we create new protocols with the aim to standardize and improve care, we must be mindful that there is appropriate flexibility, so that every patient receives patient-centered care that takes into consideration their unique circumstances.

It is our hope that these changes will improve rates at which BRI patients are provided with high-quality and appropriate instructions and resources to care for their injury. This will facilitate handoff of follow-up care to outpatient clinicians and support continued strengthening of partnerships between the ED and institutional clinics, as well as community organizations that provide BRI care.

LIMITATIONS

This cross-sectional, needs-assessment study was designed to provide only a snapshot of what is occurring in our ED to guide future research and policy efforts to improve the delivery of trauma-informed care to our patients. There are several limitations to this study including its retrospective nature, small cohort size, and single-center design. Upcoming studies will address these limitations to improve generalizability and external validity. Additionally, there is the possibility that clinicians gave verbal pain management and wound care instructions that were not documented in the written instructions. However, this would not explain inconsistencies noted in discharge prescribing practices. Finally, we did not review patients' history of opioid use nor differences in injury patterns, both of which may have influenced prescribing practices for pain control.

CONCLUSION

There is notable variability in the prescriptions and instructions provided to survivors of bullet-related injuries upon discharge from the ED. The data indicates the need for standardization of practice to ensure that BRI patients are provided with equitable and consistent care.

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Comments on "Economic Evaluation of Ultrasound-guided Central Venous Catheter Confirmation vs Chest Radiography in Critically Ill Patients: A Labor Cost Model"

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Dear Editors:

We would like to commend Dr. Ablordeppey and her colleagues for their recent publication in the *Western Journal of Emergency Medicine* evaluating the comparative labor cost of central venous catheter confirmation via point-of-care ultrasound (POCUS) vs traditional chest radiography (CXR).[1] To our knowledge, this well-designed article was the first to analyze in detail the direct labor cost of using POCUS-guided confirmation for central lines vs traditional CXR confirmation. We were surprised when the authors reported that the POCUS-guided method was only $3.82 cheaper than the CXR method. With this small cost difference, low-volume hospitals that only perform a few hundred central lines per year may be less inclined to adopt this innovative method for reasons such as the cost of added ultrasound machines, formal appropriate ultrasound training of current staff, or medicolegal concerns. Perhaps this could be one of the barriers explaining the slow adoption of POCUS-guided central line confirmations among emergency physicians and intensivists.[2]

We noticed that the article provided rather conservative estimates of the 60-hour work week salary for the physicians who performed the procedure ($1.72 per minute for emergency physicians and $1.89 per minute for radiologists). The United States (US) Bureau of Labor Statistics reported the 2021 median hourly wage for emergency physicians and radiologists as $149.35 ($2.49 per minute) and $145.06 ($2.42 per minute), respectively.[3,4] Furthermore, in the critical care resuscitation unit (CCRU) at the University of Maryland Medical Center, central lines were cannulated and confirmed mostly by our advanced practice practitioners (APP). This is a practice shared commonly with other institutions and settings.[5-7] The US Bureau of Labor Statistics reported the 2021 median hourly wage for a nurse practitioner at $59.51 ($0.99 per minute) and for a physician assistant at $58.43 ($0.97 per minute).[8,9] According to the calculations by Ablordeppey et al, the direct cost savings of POCUS-confirmation for central lines could be much greater for uncomplicated cases when they are performed by APPs ($10.56 or $10.45), as compared to the CXR method ($18.69). We acknowledge that a potential limitation to this suggestion is the lack of published data on the accuracy and feasibility of ultrasound-guided CVC confirmation that includes APPs as operators.

The application of a POCUS-guided method for central line placement would also offer significant savings in indirect costs. It has been established that it would take an average of 63.9 (± 57) minutes from the time of ordering the CXR to perform the CXR, compared with only 5.6 (± 2.5) minutes to perform a POCUS-guided technique to confirm central line placement.[10] When factoring in the labor cost of a clinician waiting for CXR confirmation, this would represent another significant area of cost-saving. At the CCRU where critically ill patients are transferred for time-sensitive diseases,[11] we receive hundreds of patients in extremis each year who need timely operative interventions. In certain instances, the CCRU team will insert central lines and perform POCUS-guided confirmation while the operating room is being prepped.

Although the coronavirus disease 2019 pandemic is slowing down, it's still not over. Another potential example of indirect cost savings using a POCUS-guided central line confirmation strategy is minimizing the exposure of personnel and equipment to transmissible pathogens, subsequently reducing the need for personal protective equipment for staff

and decontamination of the radiograph machines.

Therefore, we wholeheartedly agree with Dr. Ablordeppey and her colleagues that POCUS-guided central line confirmation is more efficient than the traditional CXR-guided method. The POCUS-guided method offers potential direct and indirect cost benefits when compared with the CXR method. We'd look forward to seeing more stakeholders move to adopt the POCUS method for central lines confirmation.

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Response to "Comments on Economic Evaluation of Ultrasound-guided Central Venous Catheter Confirmation vs Chest Radiography in Critically Ill Patients: A Labor Cost Model"

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We would like to thank Austin et al[1] for their interest in our article comparing labor costs of two approaches to central venous catheter (CVC) confirmation,[2] recently published in the *Western Journal of Emergency Medicine.* In their letter to the editor, they acknowledge that the point-of-care ultrasound (POCUS)-guided confirmation method offers direct and potential indirect cost benefits when compared with the chest radiograph (CXR) method. However, they raise several important points regarding our results. First, we reported a modest difference between direct labor cost of using POCUS-guided confirmation for central lines vs traditional CXR confirmation in our calculations. The authors expressed concern that these conservative cost savings may have less impact in smaller hospitals where only a few hundred central lines are performed annually. The authors state that the cost of added ultrasound machines, formal education of staff, and medicolegal concerns may be barriers to clinical adoption.[3,4] We did find that those were some reported barriers; however; of note, in our manuscript decision tree, there is an assumption that the ultrasound is already available for use since it is typically used to guide *insertion* of CVCs.[4] The cost of additional training of CVC confirmation has not been measured in any studies to our knowledge, and we agree that perceived medicolegal risk may be a barrier for some institutions or individuals. Our labor cost calculations were the result of conservative salary estimates of a 60-hour work week of physicians using data from 2019 estimates.[5] We note that the 2021 estimated hourly salaries reported by the authors are higher and can influence calculations.

Second, we only calculated direct cost attributed to physician confirmation and not advanced practice practitioners (APP) as several places may be accustomed. We agree that the direct cost savings of POCUS-confirmation for central lines could be greater when performed by APPs ($10.56 or $10.45), as compared to the CXR method ($18.69). This $4.31 difference between a cost savings of $3.82 (as we originally reported) vs $8.13 (that the authors report) is notable but may not be sufficient to persuade individual or institutional behavior and policy changes. Future studies understanding how facilitators like cost savings drive implementation of POCUS-guided CVC confirmation would be useful.

Finally, although we acknowledge that there is a notable time savings with POCUS confirmation[6-8] contributing to indirect costs, we did not measure them in this study. We are

pleased to hear that the critical care resuscitation unit at the University of Maryland Medical Center uses this innovative practice and can pragmatically appreciate the direct and indirect benefits of POCUS-guided CVC confirmation. The fact that a clinician can place a CVC, confirm placement, and initiate care all in one sitting without leaving the patient bedside is an important advantage to POCUS-guided confirmation. Future studies should characterize the resource implications of substituting POCUS-guided CVC confirmation more fully by conducted a comprehensive assessment of the costs of protocol development, implementation, and maintenance of this change in practice.

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