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Western Journal of *Emergency Medicine*:

Integrating Emergency Care with Population Health

Indexed in **MEDLINE, PubMed, and Clarivate Web of Science, Science Citation Index Expanded**

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JOURNAL FOCUS

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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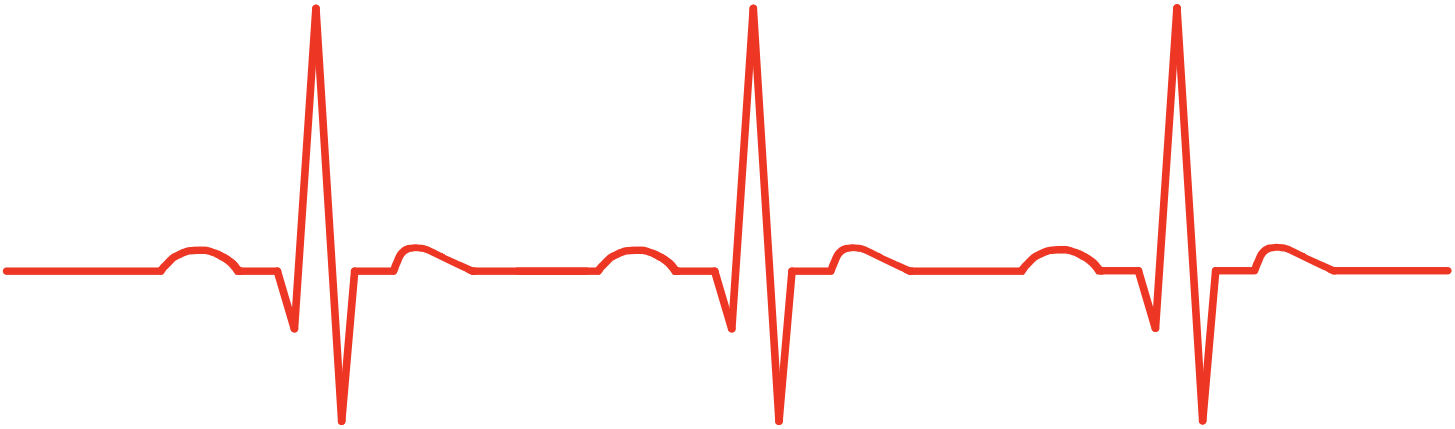

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United States Emergency Department Screening for Drug Use Among Assault-Injured Individuals: A Systematic Review

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Introduction: The clinical model of screening, providing a brief psychosocial and/or pharmacological intervention, and directly referring patients to treatment (SBIRT) is a compelling model to address drug use among assault-injured individuals in the busy emergency department (ED) setting. Our objective in this study was to examine the current literature and determine ED-based strategies that have been reported that screen, directly refer to drug mis-use/addiction specialized treatment services, or initiate addiction treatment among individuals injured by non-partner assault in the United States.

Methods: We conducted a systematic review of ED-based studies using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol. OVID, MEDLINE, OVID Embase, OVID AMED, Web of Science-Core Collection, Cochrane CENTRAL, and CINAHL were systematically searched using keywords and Medical Subject Heading terms. Studies were excluded if they only involved intimate partner assault-injury, tobacco, or alcohol use. We categorized ED-based strategies as screening, direct referral, or treatment initiation.

Results: Of the 2,076 non-duplicated studies identified, we included 26 full-text articles in the final analysis. Fourteen studies were cross-sectional, 11 were cohort, and one was case-control in design. The most common drug use screening instrument used was the National Institute on Drug Abuse Quick Screen Question. Cannabis was the most common drug detected upon screening.

Conclusion: Drug use, while highly prevalent, is a modifiable risk factor for non-partner assault-injury. The paucity of scientific studies is evidence for the need to intentionally address this area that remains a major challenge for the public's health. Future research is needed to evaluate ED-based interventions for drug use in this population. [West J Emerg Med. 2022;23(4)443–450.]

INTRODUCTION

The emergency department (ED) is often referred to as the ideal setting to identify patients with high-risk health behaviors, such as substance use, and link them to evidence-based treatment services. The clinical model of screening patients, providing a brief psychosocial and/or pharmacological intervention, and directly referring them to treatment (SBIRT) has become increasingly more common in the acute care setting.[1] The ED SBIRT, originally developed for unhealthy alcohol use, has expanded to identify and treat ED patients who report use of other substances including opioids.[2,3] Substance use is known to be associated with risk-taking related negative consequences such as injury occurrence.[4-6] As a result, more than two decades ago, the American College of Surgeons (ACS) mandated the practice of SBIRT for all trauma centers.[7] This renders the ED an

important opportunity to provide substance use treatment and potentially reduce the risk of re-injury.

Intentional injury, specifically assault-injury, presents a formidable public health burden in the United States (US). Annually, US EDs treat approximately 1.5 million individuals for non-fatal assault injuries.[8] Previous literature reports reoccurrence rates from 1% to as high as 44%.[9-15] Assault-injured individuals who report substance use are at even greater risk for re-injury. [4,15] One study demonstrated that approximately 55% of assault-injured youth compared to 40% of non-assault-injured youth in the ED have a previous history of substance use.[16] These findings suggest that ED SBIRT may be an applicable model to identify drug use among assault-injured individuals, a population at high risk for drug use and drug use disorders, and to initiate treatment in the busy ED setting.

In this review, we sought to assess the prevalence of co-occurring drug use and non-partner assault-injury in the ED. To accomplish this, our study objective was to determine what types of ED-based strategies have been reported in the published literature that screen for drug use and/or prescription medication misuse, deliver a brief intervention that targets drug use and/or prescription medication misuse, or directly refer to specialized treatment services among individuals injured by non-partner assault, each components of the SBIRT model. We further categorized each study as to whether it evaluated screening, a brief intervention, and/or referral to specialized treatment services for drug use in accordance with the SBIRT model.

We also determined the screening method for substance use that each study used (eg, National Institute on Drug Abuse [NIDA] Quick Screen Question, "How many times in the past year have you used an illegal drug or used a prescription medication for nonmedical reasons?"). For the purposes of this study, we defined non-partner assault-injury as an intentional injury inflicted by another person not considered to be a boy/girlfriend, fiancé(e), or spouse (eg, peer, coworker, stranger). This includes individuals who may have been either the victim or aggressor. Although many studies have used the term "violence" or "violent-injury" when referring to an intentional injury inflicted by another person, in this review we will use the term "assault" or "assault-injury" for the purposes of maintaining consistency and clarity. We use the term "drug use" to refer solely to the use of drugs (eg, cannabis, cocaine) and the term "substance use" to refer to the use of both drugs and alcohol.

METHODS

Search Strategy

The research team developed a protocol using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA-P) checklist.[17] The protocol was registered in PROSPERO (registration number CRD42021270663). The searches were initially performed in June 2019 and updated in September 2021. A clinical librarian designed and executed the systematic search following a consultation with the research team using the research team's protocol, "emergency department-based strategies that screen, refer to specialized treatment, or treat drug use and/or prescription drug misuse in assault-injured individuals: protocol for a systematic review," as a framework. The librarian also performed a Medical Subject Heading (MeSH) analysis of pre-identified articles using the Yale MeSH Analyzer.[18] These articles were later used to validate search concepts.

The search strategy was then peer-reviewed by another senior librarian. The search strategy used both keywords and controlled vocabulary combining the terms for drug or substance use/abuse, assault/violence or victim, and emergency department. The databases included the following: OVID Medline, OVID Embase, Web of Science, Cochrane CENTRAL, and CINAHL (See Appendix 1 search details). The final search found a total of 2177 studies with 2076 original articles. These results were exported into EndNote (Clarivate Analytics, Philadelphia, PA), where they were de-duplicated, and then uploaded to Covidence Systematic Review software (Melbourne, Australia) for screening. This study was determined to be exempt by Yale University Institutional Review Board.

Study Selection

Two authors examined the search results for studies that screen for drug use and/or prescription medication misuse, directly refer to specialized treatment, and/or initiate ED treatment for drug use and/or prescription medication misuse among non-partner assault-injured individuals (See Table).

Table. Study eligibility criteria

Inclusion criteria	Exclusion criteria
US population	• Intimate partner assault-injury only
All ages	• Tobacco use only • Alcohol use only • Results of screening, direct referral to specialized treatment or initiation of emergency department treatment for drug use and/prescription medication misuse among assault-injured individuals not reported • Studies outside the US

US, United States.

We limited our search to literature in the US population with participants of all ages. Studies of secondary analyses were included if they reported results collected from the parent study that were deemed relevant to the study objective (eg, results of screening of drug use and/or prescription medication misuse among assault-injured individuals). Studies were

excluded if they examined only intimate partner assault-injury, tobacco, or alcohol use alone. We excluded studies that examined alcohol use only to intentionally highlight knowledge gaps in the existing literature surrounding drug use and non-partner assault-injury, particularly in the setting of increasing legalization and use of cannabis.[19]

We excluded studies that examined intimate partner assault-injury only because there is a paucity of literature that evaluates drug use in non-partner assault-injury comparatively to intimate partner assault-injury. Further, we sought to intentionally identify existing knowledge gaps in the literature and inform future areas of research by consolidating the existing state of knowledge in non-partner assault-injury and drug use. All disagreements in study selection were adjudicated by a third author. After final screening of the published manuscripts, there were 26 studies used in the final analysis. The final 26 studies had substantial heterogeneity in study design, population, and main outcome. All studies were non-experimental. Of the final 26 studies, only six were prospective.

The strength of clinical data was graded according to the Oxford Centre for Evidence-Based Medicine levels of evidence, by two authors independently.[20] Disputes were resolved after discussion. Levels of evidence are as follows: level 1, randomized clinical trials (with narrow confidence intervals) or systematic reviews (with homogeneity of randomized clinical trials); level 2, well designed controlled trials (without randomization) or prospective comparative cohort trials; level 3, case-control or retrospective cohort studies; level 4, cases series (with or without intervention) or cross-sectional studies; level 5, opinion of respected authorities or case reports.

Data Extraction and Analysis

Data extraction was completed in full by the first author with input from the remaining authors. The identifying study information extracted included the title, first author, journal, specialty focus of journal, study funder, and year of publication. Key study information extracted included study objective, study design, study location, eligibility criteria, the instrument by which participants were screened, presence of drug use treatment, if any, referral to specialized drug use treatment, if any, and main outcomes relevant to this study's objective. Extensive heterogeneity of the final selected studies precluded a meta-analysis. All study information was entered in tabular format in Microsoft Excel version 16 (Microsoft Corporation, Redmond,WA).

RESULTS

Search results

A flow chart of the study selection results can be seen in the Figure PRISMA diagram. The literature search resulted in 2,177 studies imported for screening. We identified 101 studies as duplicates and removed them, leaving 2,076 titles and abstracts. Of those abstracts, 1,984 studies (95.6%) were excluded after a title and abstract screening leaving 92 studies for full-text review. Of the 92 full-text studies, 66 studies were excluded because of wrong study design, no full-text was available (eg, conference abstracts), wrong patient population (eg, intimate partner assault-injured individuals only), wrong study setting, wrong study outcomes, or were additional duplicates. Twenty-six studies remained for the final analysis.

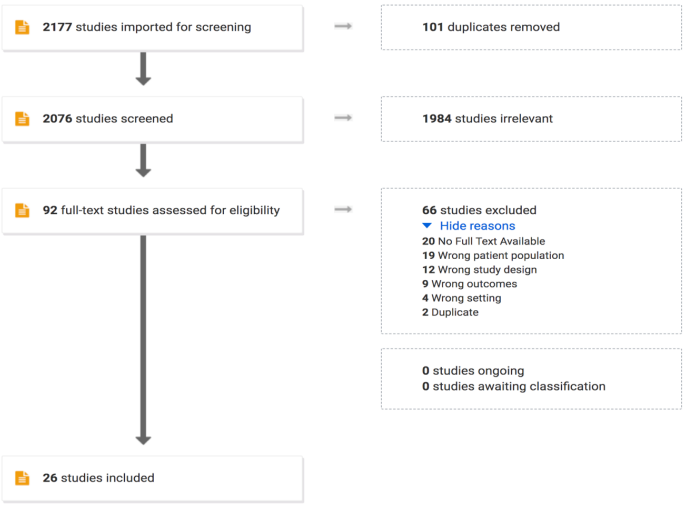

Figure. PRISMA diagram details our search and selection process applied during systematic literature search and critical review. *PRISMA,* Preferred Reporting Items for Systematic Reviews.

Characteristics of included studies

The general characteristics and main results of the 26 studies are displayed in Appendix 2. The earliest article was published in 1999,[21] while the most recent study was published in 2021.[22] The journal categories of the 26 studies included the following: substance use/addiction (10/26); pediatrics (6/26); emergency medicine (5/26); public health (3/26); and medicine (2/26). Seventeen studies were funded by the NIDA,[15,16,23-36] 13 by the National Institute on Alcohol Abuse and Alcoholism,[22-25,30,32,35,37-41]eight by the US Centers for Disease Control and Prevention (CDC),[16,25-27,29,31,34,42,43] one by the National Institute of Mental Health,[21] one by the Department of Surgery at the University of Texas Southwestern Medical School,[44] and one was not listed. [45] Fourteen studies were cross-sectional.[16,23-25,27,28,33,36-42] nine were retrospective cohort,[22,26,29-32,34,35,45] two were prospective cohort,[5,44] and one was a case-control.[21]

Study Populations

Together, the 26 study populations spanned all ages. Fourteen studies focused on both adults and adolescents, nine on adults, and three on adolescents. The mean age of the participants ranged from 14.5-38.6 years. Thirteen studies were secondary analyses of prospective studies, which were included. None of the studies were of multiple sites.

Assessment of Substance Use

All studies screened for self-reported drug use among assault-injured participants either by computerized/written survey or in-person interview. Of the 26 studies, five studies screened for recent drug use by either survey or in-person interview without a formal screening instrument.[21,37,38,44,45] Of the remaining 21 studies, 14 used a combination of the NIDA Quick Screen Question and Modified Alcohol, Smoking and Substance Involvement Screening Test (ASSIST),[15,16,22,25-32,34-36] three used the Substance Abuse Outcomes Module (SAOM),[23,24,39] two used questions from the Monitoring the Future study to detect prior-year cannabis use,[40,41] one used questions from the Supporting Adolescents with Guidance and Employment survey to detect past 12-month substance use,[42] and one used the Texas Christian University Drug Screen to determine past 30-day substance use.[33]

Drug Use Among Assault-injured Individuals in the Emergency Department

Among all studies, drug use was found to be closely linked to assault-injury. Study results reported of this relationship were heterogenous. Four of 26 studies found a range of 25-61% of assault-injured individuals who reported drug use within the preceding 12 months.[23,33,37,45] Three studies reported that previous drug use of any type was significantly associated with 1.43-7.41 greater odds of either previous or acute assault-injury.[21,23,42] Two studies reported that assault-injury was significantly associated with 1.55-1.84 greater odds of previous drug use.[16,27]

Types of Drugs Used

Overall, cannabis was the most common drug identified among assault-injured individuals. Eight studies reported cannabis use among assault-injured individuals ranged from 32.1-96.7%.[15,16,21,23,24,27,37,42] Three studies found that cannabis use was significantly associated with 2.1-7.41 greater odds of assault-injury.[21,23,42] Two studies found that cocaine use was also significantly associated with 2.7-3.1 greater odds of assault-injury.[21,23] One study found prescription drug misuse was significantly associated with a 1.43 greater odds of assault-injury.[23]

DISCUSSION

In this systematic review, we identified ED-based studies that screen, treat, and/or directly refer to specialized treatment services for drug use among assault-injured individuals. Our comprehensive literature search determined that there were 26 studies that met criteria for inclusion. The studies in this review used various screening modalities to identify drug use including an in-person interview as well as computerized and written versions of validated screening instruments for drug use. None of these studies were interventional nor did they provide a direct referral to specialized treatment services. The vast majority of studies found a high prevalence of drug use within this population, with cannabis being the most common drug detected.

Although study results were fairly heterogenous, the majority of them found high rates of drug use among assault-injured individuals, especially when compared to those injured by other mechanisms. Previous literature demonstrates a close link between assault-injury and drug use.[15,37,38,42,44,46-50] Several pre-existing theories have explained this relationship including the shared risk factors between assault-injury and drug use, the pharmacologic effects of drug use, and the association between assault-injury and the illegal drug trade.[51-53] Evidence shows that substances such as alcohol, cocaine, amphetamine-type stimulants, phencyclidine, and barbiturates cause increased aggression and impaired judgment.[51,54,55] However, cannabis was among the most common drugs detected in our review. The evidence to support its role in causing aggressive behavior is mixed.[43,56-58] It is more likely that the relationship between cannabis use and assault-injury is associated with the effects of withdrawal, shared risk factors of problem behavior, and facets of the illegal drug trade.[50,51,53] Additionally, cannabis use may also allow assault-injured individuals to mitigate aggression and cope with its negative effects.[50,51] Future studies are needed to better elucidate this relationship.

The practice of SBIRT to facilitate future treatment engagement for drug use in the ED setting has become increasingly common.[59,60] SBIRT has shown some promise in identifying and managing unhealthy alcohol use and opioid use disorder (OUD), particularly when paired with pharmacotherapy (eg, buprenorphine for OUD).[2,3] Studies in this review used various screening methods to identify drug use among assault-injured individuals. Several validated screening instruments for drug use exist, yet very few have been evaluated in the ED setting. Nineteen studies used one of the following formal screening instruments: the SAGE, SAOM, Texas Christian University Drug Screen, and the NIDA Quick Screen Question, and Modified ASSIST. The NIDA Quick Screen Question, "How many times in the past year have you used an illegal drug or used a prescription medication for nonmedical reasons?", is likely best suited for the ED clinical care context.[1] This single question was found to be 100% sensitive for detecting drug use in the primary care setting.[61] Among high-risk populations such as assault-injured individuals, this instrument has the potential to be the most effective in identifying drug use in the busy ED setting.

Despite the ACS mandating the practice of SBIRT at all trauma centers for over two decades,[7] our review demonstrates a marked paucity of literature that examines all aspects of SBIRT for drug use among assault-injured individuals in the ED setting. This includes the practices of brief intervention and/or referral to specialized treatment services for drug use. This is particularly concerning because the literature supports a strong association between non-partner assault-injury and drug use. Moreover, the COVID-19 pandemic, its associated prevention

efforts, and accompanying financial stress have exacerbated both substance use and assault-injury.[62] Yet substance use is a potentially modifiable risk factor, as evidence-based behavioral and pharmacological interventions exist.[1,63]

This gap in literature may be explained by the challenges of engaging the intersection of two exceptionally vulnerable populations that do not often seek healthcare with regularity.[64,65] Both assault-injury and drug use are sensitive topics to research likely due to a combination of stigmatization, fear of law enforcement involvement, their shared emotional impact, and a host of other shared socioeconomic factors including poverty and racism.[48,66-69] Furthermore, obtaining funding for assault-injury research is notoriously challenging, particularly for firearm-inflicted injuries.[70,71] This may serve as an additional barrier in performing research in this vulnerable population. Other notable challenges in conducting research in this population include participant loss to follow-up by attrition (eg, unable to contact or death), undocumented immigrant status and fear of deportation, and a lack of viable and sustained community resources where patients can be referred for counseling and treatment services.[32,72,73]

Additionally, our review highlights several knowledge gaps in the existing literature surrounding drug use in the context of non-partner assault-injury. Little is known about the mutual risk factors, notably socioecological and psychological, that may contribute to the co-occurrence of assault-injury and drug use, both considered to be problem behaviors.[53,74,75] Further, in our review, no study evaluated the potential impact of an intervention, such as a brief behavioral intervention, to reduce drug use and subsequent injury. This is particularly compelling because previous literature has shown that a brief behavioral intervention, delivered in the ED setting, demonstrates considerable promise in reducing cannabis use and its related harm as well.[76,77] Future studies may use existing theory such as the social-ecological model to inform the development of an intervention that reduces the burden of drug use and injury. [78]

LIMITATIONS

The authors of the identified studies noted several limitations. One main limitation was the potential for social desirability bias in self-reported high-risk behaviors including drug use and injury mechanism due to fear of legal repercussions or embarrassment. The studies also cited small sample sizes as well as potentially limited generalizability from performing research at a single study site. Lastly, 13 of the studies included in this review were secondary analyses of two parent studies (also included in this review). Findings from these studies may also potentially limit generalizability.

CONCLUSION

To the best of our knowledge, this review of ED-based literature that focuses on the use of screening, providing a brief intervention, and/or direct referral to specialized treatment for drug use in assault-injured individuals is the first of its kind. Existing literature included within this review supports a close relationship between non-partner assault-injury and drug use. However, results of this review highlight a substantial gap in literature that seeks to understand the complex nature of substance-use behaviors and potential interventions in this exceptionally vulnerable population. Emergency departments should consider implementing routine use of the SBIRT model to identify and treat drug use in assault-injured individuals. Areas of future investigations include ED-based interventions for drug use in this population, their potential effects on preventing re-injury, and the role that specific drugs, such as cannabis, serve in inciting aggressive behaviors and coping with its negative effects.

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Implementing a Novel Statewide Network to Support Emergency Department-initiated Buprenorphine Treatment

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Introduction: Medications for opioid use disorder (MOUD), including buprenorphine, represent an evidence-based treatment that supports long-term recovery and reduces risk of overdose death. Patients in crisis from opioid use disorder (OUD) often seek care from emergency departments (ED). The New York Medication for Addiction Treatment and Electronic Referrals (MATTERS) network is designed to support ED-initiated buprenorphine and urgent referrals to long-term care for patients suffering from OUD.

Methods: Using the PRECEDE-PROCEED implementation science framework, we provide an overview of the creation of the MATTERS network in Western New York. We also include an explanation of how the network was designed and launched as a response to the opioid epidemic. Finally, we analyzed the program's outputs and outcomes, thus far, as it continues to grow across the state.

Results: The New York MATTERS network was created and implemented in 2019 with a single hospital referring patients with OUD to three local clinics. In the social assessment and situational analysis phase, we describe the opioid epidemic and available resources in the region at the outset of the program. In the epidemiological assessment phase, we quantify the epidemic on the state and regional levels. In the educational and ecological assessment, we review local ED practices and resources. In the administrative and policy assessment and intervention alignment phase, the program's unique framework is reviewed. In the piloting phase, we describe the initial deployment of New York MATTERS. Finally, in the process evaluation phase, we depict the early lessons we learned. By the beginning of 2021, the New York MATTERS network included 35 hospitals that refer to 47 clinics throughout New York State.

Conclusion: The New York MATTERS network provides a structured approach to reduce barriers to ED-initiated buprenorphine and urgent referral to long-term care. An implementation framework provides a structured means of evaluating this best practice model. [West J Emerg Med. 2022;23(4)451–460.]

INTRODUCTION

Opioid analgesic prescribing in the United States increased through the early 2000s, resulting in considerable increases in emergency department (ED) visits, inpatient hospitalizations, and overdose deaths.[1-5] Nationally representative data from the National Hospital Ambulatory Medical Care Survey shows that the ED visit rate for opioid overdose increased fourfold from 1993 to 2010.[3] Despite a national effort to control the epidemic of non-medical use of opioid analgesics and a plateauing of opioid analgesic-related ED visits[6] and mortality rates[7] in the early 2010s, the prevalence of heroin use rose dramatically during the same time period, with over 620,000 Americans reporting the use

of heroin in 2011.[8] The recent addition of fentanyl to the supply of heroin and other street drugs has resulted in a further increase in the risk of opioid overdose death[9,10] observed across men and women and various racial/ethnic groups.[11] Recent data shows that patients who are treated in the ED for non-fatal opioid overdose are at elevated risk for post-discharge mortality.[12,13]

Given that patients with opioid use disorder (OUD) frequently present to hospital EDs for acute opioid overdoses,[12,13] opioid withdrawal symptoms,[14] opioid-related infections,[5] and concomitant psychiatric emergencies,[9] these visits represent a critical opportunity for intervention to reduce opioid-related morbidity and mortality. Few hospitals have dedicated inpatient units for treatment of OUD; so most patients presenting at EDs with acute opioid overdose or withdrawal symptoms are stabilized and treated with non-narcotic symptom-relieving medications before being discharged.[15,16] While some EDs have been able to leverage a harm reduction approach by providing take-home naloxone,[17] this strategy has not shown long-term mitigation of overdose risk and subsequent ED presentation.[18]

Medications for opioid use disorder (MOUD), including buprenorphine, represent an evidence-based treatment for OUD that supports long-term recovery and reduced risk of overdose death.[19] Given that ED visits represent a critical and time-sensitive point for patients with OUD, there has been a call for EDs to engage these patients with buprenorphine as a means of life-saving treatment.[20] There is a growing body of literature demonstrating the feasibility and effectiveness of ED-administered buprenorphine.[14,21-24]

In emergency settings, patients who receive buprenorphine for opioid withdrawal are significantly more likely to be receiving MOUD one month after ED discharge than patients treated in the ED with clonidine, a non-narcotic, symptom-relieving medication.[25] However, many of the studies demonstrating the feasibility of ED-administered buprenorphine refer these patients to a single hospital-affiliated clinic for ongoing MOUD, which is not a universally replicable model. Further, these pilot interventions do not address issues related to patients' ability to afford MOUD after leaving the ED, which is important given that OUD is more prevalent among people who are uninsured, unemployed, and/or living in poverty.[26] This necessitates a broader network of hospitals and community-based MOUD clinics and consideration of the financial burden of MOUD in addressing the opioid epidemic via ED-initiated buprenorphine.

Given the promise of ED-initiated buprenorphine as a public health approach to addressing the opioid epidemic[20] and the need for a more scalable intervention model, the current study examines New York MATTERS (Medication for Addiction Treatment and Electronic Referrals), a novel statewide network developed as a public health response to the opioid epidemic that operates through ED-initiated buprenorphine treatment and linkages to community-based care. This paper describes the assessment, implementation, and evaluation tasks completed to date of New York MATTERS within the context of PRECEDE-PROCEED,[27] a public health model for intervention planning and evaluation. This study was reviewed and approved by the Institutional Review Board of the University at Buffalo.

Population Health Research Capsule

What do we already know about this issue?
Patients with opioid use disorder (OUD) often turn to an ED in times of crisis. Buprenorphine has demonstrated efficacy for the treatment of OUD.

What was the research question?
Using the PRECEDE-PROCEED framework, we describe the creation of a network to support ED-initiated buprenorphine treatment.

What was the major finding of the study?
We demonstrate that the establishment of a large-scale network to support ED-initiated buprenorphine and referrals for ongoing care is feasible.

How does this improve population health?
The Medication for Addiction Treatment and Electronic Referrals network represents a best practice model for ED-initiated buprenorphine and referrals for ongoing OUD care.

METHODS

New York MATTERS originated in late 2017 in Erie County. Located in western New York State, it is the ninth most densely populated of the state's 62 counties. It is a racially and ethnically diverse county that includes Buffalo, the second largest city in the state. The New York MATTERS network originated in a university-affiliated teaching hospital located in Buffalo, NY.

PRECEDE-PROCEED[27] is a framework used for health promotion planning and evaluation. PRECEDE is an acronym that stands for "*predisposing, reinforcing, and enabling constructs in educational/ecological diagnosis and evaluation*"[27] and represents a series of assessments that generate information used to guide subsequent decisions in the design and implementation of the intervention. The first four phases of the model represented by PRECEDE are as follows: 1) social assessment and situational analysis; 2) epidemiological assessment; 3) educational and ecological assessment; and 4) administrative and policy assessment and intervention alignment. PROCEED, the second half of the model, stands for "*policy, regulatory, and organizational constructs in educational and environmental development.*"[27] Phases 5–8 represented by PROCEED include the following: 5) implementation; 6) process

evaluation; 7) impact evaluation; and 8) outcome evaluation. Using a rapid implementation science approach, we completed phases 1–6 of PRECEDE-PROCEED and report the results here. Data regarding the effects of the New York MATTERS network intervention on patients' health and quality of life is still being collected. Thus, we excluded data for Phases 7 and 8 of PRECEDE-PROCEED from the current study. An adapted PRECEDE-PROCEED framework that informed this intervention is shown in **Figure 1**.

Phase 1: Social Assessment and Situational Analysis

In response to the rapidly evolving opioid epidemic, Erie County declared a public health crisis in 2016 and formed an Opioid Epidemic Task Force through executive order. This task force included members of the community (including those with and impacted by OUD), emergency physicians, outpatient community-based MOUD physicians, members of the Erie County Department of Health, and representatives from regional health insurers, as well as members of local law enforcement and the District Attorney's Office who deal with drug-related criminal justice issues. Through observation of monthly workgroup meetings, the challenges and priorities of people with OUD living in Erie County were subjectively defined.

Phase 2: Epidemiological Assessment

We accessed aggregated state population data[28] to understand vital indicators of the opioid epidemic in Erie County, NY. Indicators included opioid-related mortality rates, opioid-related ED visits and hospitalizations, and opioid-related treatment entries in community-based settings. These data were used to rank and prioritize problems related to the issues identified in Phase 1.

Phase 3: Educational and Ecological Assessment

Following our epidemiological assessment of the opioid crisis in Erie County, we explored the educational and ecological needs of emergency physicians. We informally conducted key informant interviews with two emergency physicians at a single teaching hospital and identified predisposing, enabling, and reinforcing factors[27] to implementing ED-initiated buprenorphine and establishing linkages to community-based clinicians. One physician interviewed is the director of emergency medicine (EM) at a teaching hospital in Erie County and is board certified in EM. This senior physician practices EM at two community hospitals, serves as a technical advisor for the state and local departments of health, and notably serves on an advisory panel of the state's Office of Addiction Services and Supports. This physician also engages in prehospital care by serving as medical director for an emergency air medical transport service and several fire and police departments in the region. The second physician interviewed is board certified in EM and practices at three hospitals in Erie County. This physician also serves as the medical director for several fire departments in the region.

Phase 4: Administrative and Policy Assessment and Intervention Alignment

We matched our strategies and intervention components with the desired outcomes identified in Phase 1 and Phase 2 and determined whether the capabilities and resources were available to develop and implement the program.[27] Through a review of state and local policy data and multiple meetings with the Opioid Epidemic Task Force, we determined the feasibility of the New York MATTERS network and created a list of intervention components and their alignment to identify predisposing, enabling, and reinforcing factors is presented.

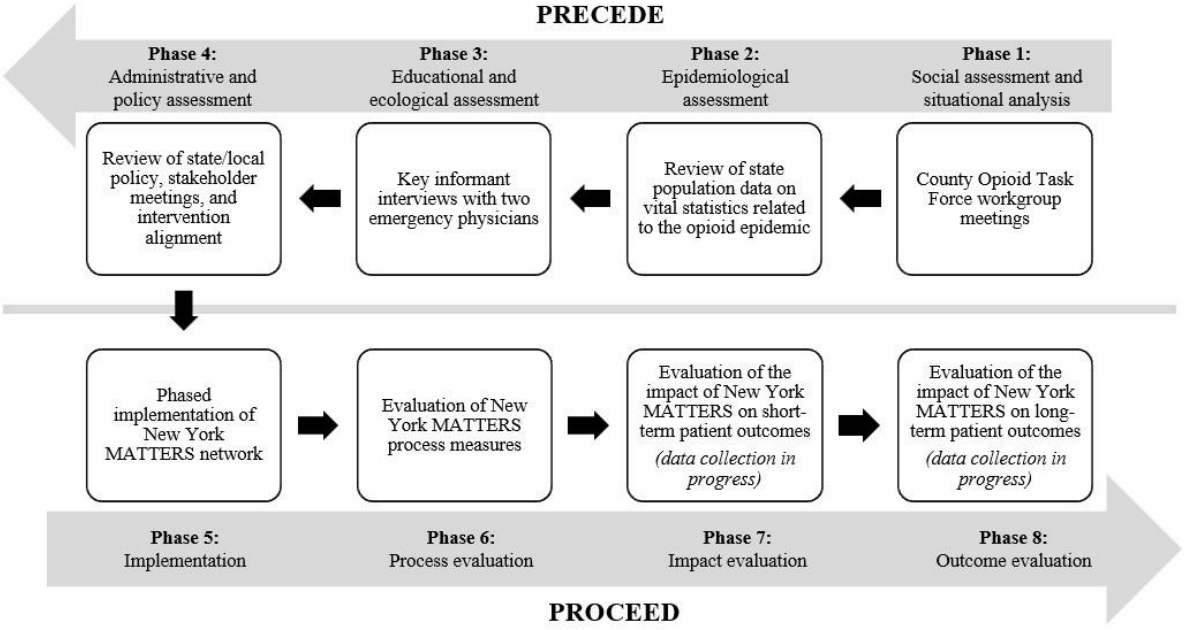

Figure 1. Adapted PRECEDE-PROCEED framework.
MATTERS, Medication Treatment and Electronic Referrals network.

Phase 5: Implementation

Using resources identified in Phase 4 and aligned intervention components, the New York MATTERS network began a phased approach to implementation in 2017. We present a timeline of the New York MATTERS implementation network and describe the phased implementation approach.

Phase 6: Process Evaluation

Following the initial launch of the New York MATTERS network, a continuous quality improvement process began. A trained program coordinator maintained a database of process outcomes that included the following: the number of participating hospitals and other referral sites; the number of participating community-based MOUD clinics; the number of participating pharmacies; the number of emergency physicians, nurse practitioners, and physician assistants (collectively referred to as EM clinicians) trained in buprenorphine prescribing; and the number of patients served. Additionally, necessary modifications to the intervention were identified and made during the scale-up process of the phased implementation and are described.

RESULTS AND DISCUSSION

PHASE 1: Social Assessment

Following the formation of the Opioid Epidemic Task Force, the challenges and priorities of people with OUD living in Erie County were defined and committees were formed to address each identified problem area. This process resulted in the formation of a "Hospital ER Committee" to focus on hospital access to MOUD as a public health approach to treating patients with OUD who present to the ED. This committee was led by an emergency physician and included representatives from all major hospital systems in the region, emergency medical services (EMS) agencies, and counselors from the county's 24/7 addiction hotline. These committees each meet approximately once per month, and the full Opioid Epidemic Task Force meets quarterly where committees report on progress. The formation of the Hospital ER Committee brought together leaders from local hospitals with a focus on this goal and allowed them to leverage the expertise of other stakeholders from the larger task force.

PHASE 2: Epidemiological Assessment

Aggregated population data[28] documented a significant increase in opioid-related mortality in New York State; the age-adjusted rate of opioid overdose deaths increased nearly threefold from 5.4 per 100,000 population in 2010 15.1 per 100,000 population in 2016, with the greatest increases in heroin (1.0 to 6.5 per 100,000 population in 2010 and 2016, respectively) and synthetic opioid overdose (0.9 to 8.3 per 100,000 population in 2010 and 2016, respectively) death rates. County-specific data revealed that Erie County had the highest number of opioid overdose deaths in 2016 (N = 274), second only to Suffolk County (N = 344), which has a much larger population. In 2016, Erie County also had an opioid overdose mortality rate that was more than twice that of the state as a whole, at 31.3 per 100,000 population.

Data shows that the crude rate of opioid overdose ED visits in 2016 was 56.9 per 100,000 population across New York State but was 139.8 per 100,000 in Erie County that same year, higher than any other county in the state. However, New York State had a crude rate of opioid-related hospital discharges of 130.2 per 100,000 population in 2016, while Erie County's rate of opioid-related hospital discharges was only 90.2 per 100,000 population. This suggested that the greatest hospital burden of opioid overdose was occurring in the ED setting in Erie County, whereas other counties may have had more dedicated inpatient units for the treatment of OUD.

Despite having some of the highest rates of opioid overdose mortality and ED visits in New York State, Erie County's rate of patient admissions into a state-certified outpatient treatment program in 2017 was 474.8 per 100,000 population, falling below that of 30 other counties in the state. This suggested that there was unrealized potential to address the opioid epidemic by facilitating linkages from the ED to outpatient treatment programs in Erie County. This data was discussed and supported the notion of expanding access to MOUD in ED settings and establishing a network to enable patients to link to outpatient programs for continued MOUD. The data was also useful in demonstrating the extent of these challenges to hospital leaders outside of the EDs as well as potential external funders.

Phase 3: Educational and Ecological Assessment

The two emergency physicians interviewed as key informants identified several predisposing, enabling, and reinforcing factors[27] to implementing ED-initiated buprenorphine and establishing linkages to community-based MOUD clinics **(Table 1)**. These findings are important because they illuminate barriers and facilitators to implementing this type of intervention that may be common to other communities affected by the opioid crisis.

Predisposing Factors

Clinician self-efficacy to appropriately determine buprenorphine dosing. The appropriate, patient-specific, starting buprenorphine dose is typically determined through an assessment of the patient's opioid use patterns and risk for withdrawal. The dose is then slowly titrated upward until withdrawal symptoms are satisfactorily abated. Clinicians expressed concern regarding their ability to properly determine the appropriate dose, and the time and resources needed in a busy ED to observe the patient during a gradual titration.

Clinician self-efficacy to provide patients with follow-up instructions. Once patients are discharged from the hospital, they require clear follow-up instructions. Clinicians admitted that they did not feel sufficiently knowledgeable to instruct patients on how to take buprenorphine at home (especially the first dose), how to obtain medication if they did not have health insurance, and how to navigate their first

Table 1. Predisposing, enabling, and reinforcing factors for emergency clinicians to prescribe buprenorphine and refer patients to follow-up clinic.

Predisposing factors	Enabling factors	Reinforcing factors
Clinician self-efficacy to appropriately determine buprenorphine dosing	Clinician X-waiver to prescribe buprenorphine	Extrinsic motivation to obtain/ maintain X-waiver
Clinician self-efficacy to provide patients with follow-up instructions	Process for timing and location of clinician referral to community-based clinic	
Clinician perceived risk of buprenorphine diversion	Process for scheduling follow-up appointment at community-based clinic	
	Patient ability to pay for buprenorphine prescription	

follow-up appointment. Literature suggests that clinicians are apprehensive about unobserved "home" buprenorphine induction due to the risk of diversion and precipitated withdrawal.[29] However, this method has been shown to be feasible with low rates of adverse events.[30]

Clinician-perceived risk of buprenorphine diversion. Both licit and illicit opioids can be bought and sold on the street. Clinicians expressed concern that the medication they prescribed in the ED would be sold by patients or otherwise diverted. This is a common perception among buprenorphine prescribers in the United States.[31]

Enabling Factors

Clinician X-waiver to prescribe buprenorphine. In addition to a standard Drug Enforcement Administration (DEA) license, at the time of the rollout, physicians were required to complete an eight-hour training to obtain an "X-waiver" to prescribe buprenorphine. Nurse practitioners and physician assistants were required to complete 24 hours of training to obtain the waiver. Clinicians in the ED perceived this requirement as a barrier, in addition to the multiple other unfunded certification courses they must complete for licensure and hospital privileges.

Process for timing and location of clinician referral to community-based clinic. Based on the experiences shared by patients with OUD, clinicians worried that they would not be able to secure immediate follow-up appointments for their patients with a community-based clinician following an ED visit. In addition to the timing of a follow-up appointment, clinicians expressed concern about the multiple permutations necessary to determine the appropriate clinics to which they could refer patients. At the time, there were several community-based MOUD clinics in the region and each had unique rules regarding patient acceptance, such as health insurance coverage, concomitant benzodiazepine use, or a previous discharge because of failure to follow the clinic policies.

Process for scheduling follow-up appointment at community-based clinic. Given the heterogeneity of community-based clinics and scheduling processes, clinicians expressed a desire for a streamlined process to schedule patients' follow-up appointments. Clinicians indicated that a streamlined process would reduce the time and administrative burden of linking patients to community-based care for continuing MOUD.

Patient ability to pay for buprenorphine. Many patients with OUD are uninsured or underinsured.[26] Clinicians expressed concern about their patients' ability to afford a prescription of buprenorphine outside a safety net setting and identified this as a practical barrier to implementing ED-initiated buprenorphine.

Reinforcing Factors

Extrinsic motivation to obtain/maintain X-waiver. Clinicians identified the need for some type of extrinsic motivation to reinforce ED clinicians' securing and maintaining DEA X-waivers to prescribe buprenorphine. Research has shown that "pay-for-participation" incentives like honorariums are a viable strategy to motivate clinician behavior.[32]

Phase 4: Administrative and Policy Assessment and Intervention Alignment

Standardized dosing scheme for clinicians. To improve ED clinicians' self-efficacy with buprenorphine dosing, a standardized dosing scheme was created. The program first recommended an initial 4-milligram (mg) dose of buprenorphine followed by 4 mg of buprenorphine twice a day for three days. This recommended standardized dosing scheme was created by the physician leadership of the program in consultation with local addiction medicine specialists. Prescribers were still able to use a patient-specific dose and duration at their discretion, but most clinicians used the standardized scheme.

Standardized patient instructions for clinicians. To address ED clinicians' self-efficacy to provide patients with follow-up instructions, standardized patient instructions were created as part of a packet that could easily be used by emergency clinicians. The packet included a decision-support flow chart, the phone number to the central referral line, and discharge instructions with blank spaces for patient-specific instructions, such as the date and location of their follow-up

appointment. Not all patients with OUD presenting to EDs are appropriate for buprenorphine induction in the ED. For patients who were not induced in the ED, these instructions also included guidance on when to take their first dose of medication using non-technical language.

Diversion education for clinicians. To address concerns about buprenorphine prescription diversion by ED patients, ED clinicians were educated regarding the true buprenorphine diversion risk. Evidence shows that the majority of people who use illicit buprenorphine do so to manage opioid withdrawal symptoms or achieve or maintain abstinence from other opioids.[33] Buprenorphine diversion is frequently a reflection of a persistent lack of treatment availability and barriers to buprenorphine access among people with OUD.[34]

Funded hybrid trainings for clinicians. To facilitate clinicians' obtainment of a DEA X-waiver to prescribe buprenorphine, the Department of EM at the university affiliated with the hospital streamlined the waiver process to make participation more appealing. Leveraging a hybrid model, physicians first participated in four hours of online, asynchronous training and then attend a four-hour, face-to-face training. These regional trainings were funded by the university's ED and were held at restaurants to foster a collegial environment and encourage clinician participation.

Mission, vision, and values document for clinic participation in network. To facilitate a process for timing and location of clinician referral to community-based clinics, a mission, vision, and values document was created to detail the goals of the network and the obligations of both ED clinicians and clinics receiving referrals through the network. A key component of this document was the obligation for clinics to accept all patients referred through the network. If a clinic could not meet the needs of a particular patient, it was the clinic's responsibility to initiate care and then facilitate a secondary referral. Participating clinics included those that were single site, multisite, urban, suburban, and rural. Leadership from these clinics were asked to identify days of the week in which they would have the ability to accept a patient from the referral network to ensure that patients were seen within 24-72 hours after their ED visit. These were not dedicated appointments; rather they were periods in which the clinic felt their capacity was adequate to absorb an additional patient into the schedule on short notice. The referral process provided patients with the date and location of their first follow-up appointment. The clinic contacted the patient on the next business day to select a mutually agreeable appointment time.

Centralized referral system. To address clinicians' desire for a streamlined process for scheduling a follow-up appointment at a community-based clinic, a centralized referral system was developed. A referral phone line with 24/7 availability was established by partnering with an EMS dispatch center. This enabled ED staff to call the hotline and instantly find clinic availability within the necessary referral period. Once an appropriate clinic appointment was selected, the dispatcher obtained patient information and sent it directly to the community-based clinic via a fax that was compliant with the Health Insurance Portability and Accountability Act (HIPAA). The dispatcher would also note that the scheduled clinic appointment was no longer available in the master log to avoid double-booking clinics.

Patient voucher for buprenorphine prescription. To address patients' ability to pay for their buprenorphine prescription, New York MATTERS founders established a voucher program. This program provided patients' initial outpatient buprenorphine prescription at no cost through the use of a voucher if they could not afford the medication. All uninsured patients and patients who reported that they were covered by Medicaid were automatically given a voucher for buprenorphine. If the patient arrived at the pharmacy and had active insurance, then the voucher was not charged. This was established through a partnership with a local pharmacy association that had experience with operationalizing voucher programs and had relationships with a network of local pharmacists who were willing to honor their vouchers. Patients identified as uninsured or underinsured received a voucher in the ED with information on participating pharmacies.

Clinician honorariums. To facilitate clinicians' extrinsic motivation to obtain and maintain a DEA X-waiver to prescribe buprenorphine, the Department of EM at the university affiliated with the hospital where New York MATTERS originated provided $200 honorariums to clinicians once they completed the required training and obtained their DEA X-waiver. This was a temporary incentive offered only during the piloting and early phasing in of New York MATTERS. A summary of the intervention components is shown in **Table 2.**

Phase 5: Implementation

Piloting

New York MATTERS originated in late 2017 and was piloted under the name "Buffalo MATTERS." The initial launch was supported by a one-year, $200,000 grant from a community-based, not-for-profit organization. The pilot network consisted of one teaching community hospital (including two emergency physicians) and three community-based MOUD clinics. During this pilot stage, the clinician and patient worked together to complete a short, paper referral form with questions on patient contact information, medical history, past drug use, and mental health history. On the final page, the patient then ranked which clinic they would like to go to. The patient was also given buprenorphine discharge instructions. The clinician, unit secretary, or counselor called the centralized referral line with this information, and it was recorded on a master spreadsheet. Once the appointment slot was determined, patient information was relayed by the dispatcher to the appropriate clinic's intake department, which then contacted the patient to confirm the exact appointment time.

Phasing In

Over the next three and one-half years, New York MATTERS continued with a phased-in approach to implementation **(Figure 2)**. New hospitals and community-based MOUD clinics joined the network after reviewing the mission, vision, and values document and agreeing to the obligations of both ED clinicians and clinics receiving referrals through the network. After clinic leadership agreed to these obligations, they completed a short, data collection form, which included information on clinic location, contact information, MOUD types prescribed (ie, buprenorphine, naltrexone, methadone), and appointment availability. Clinics provided appointment "slots," as opposed to exact appointment times, given that the slot may or may not need to be used. For example, a clinic might offer two appointment slots every Monday and Wednesday where they agree to "squeeze in" a patient.

Phase 6: Process Evaluation

Data collected by the program coordinator indicates that the network expanded from a small regional pilot to a statewide network of ED-initiated buprenorphine treatment and linkages to community-based care. To date, the New York MATTERS network includes 35 hospitals and a total of 47 community-based clinics across 83 individual sites (Table 3). Additionally, 22 pharmacies now partner with New York MATTERS and accept the network's MOUD vouchers. A total of 228 ED clinicians have been trained by the network in buprenorphine prescribing and obtaining an X-waiver, and 394 patients with OUD have received ED-initiated buprenorphine and were referred to community-based care with a community-based network MOUD clinic. Further, leadership from an additional 12 hospitals and 14 community-based clinics have expressed an intent to join the network over the next year, expanding the size of New York MATTERS to an expected 49 hospitals and 61 community-based clinics by 2022.

The process evaluation also identified several modifications that needed to be made to the intervention. The centralized referral system was critical to the initial launch of New York MATTERS. However, the growing number of available clinics and the need to standardize the data collection process for referrals required a more robust information technology solution. Through a partnership with the New York State Department of Health, an online referral portal was created. Instead of a paper referral form, patients reviewed a growing list of clinics via a Wi-Fi-enabled tablet prior to their departure from the ED. After entering their information, patients were able to view a list of available clinics and dates from which to choose follow-up care. Patients could search for specific clinics, look for available sites near their homes, and select a site based on MOUD types available at that location.

Additionally, despite follow-up appointments being scheduled within 72 hours of discharge, we identified several instances when an appointment needed to be postponed or authorized prescribers were not available for the first clinic appointment. Feedback from patients and clinicians, as well as observed best practices in other areas, suggested that the initial dose of 4 mg of buprenorphine was insufficient for induction. Accordingly, the standardized dosing scheme was changed to 8 mg for induction and 4 mg twice a day for seven days for the initial prescription. This change provided an adequate "bridge" prescription for buprenorphine until patients could be seen for follow-up in a community-based setting for continued MOUD.

The referral phone line was invaluable to the initial launch of the program. As the program continued to grow, the volume and scope of the referral network necessitated a more robust referral solution. Partnering with the New York State Department of Health, a secure, HIPAA-complaint, scalable, online referral system (OLRS) was created. Participating EDs were supplied with iPads that could be used to access the OLRS. This OLRS allowed patients and clinicians to enter patient information, browse the available referral sites, confirm their referral date and location, and generate electronic discharge instructions. Referral information was sent directly to the receiving clinic, eliminating the need for a phone call in the ED. Additionally, the OLRS's functionality allowed for facilitation of linkage to peers, electronic medication vouchers, and sending discharge

Table 2. Intervention alignment to identified factors

Identified factors	Aligned intervention component
Clinician self-efficacy to appropriately determine buprenorphine dosing	Standardized dosing scheme for clinicians
Clinician self-efficacy to provide patients with follow-up instructions	Standardized patient instructions for clinicians
Clinician perceived risk of buprenorphine diversion	Diversion education for clinicians
Clinician X-waiver to prescribe buprenorphine	Funded hybrid trainings for clinicians
Process for timing and location of clinician referral to community-based clinic	Mission, vision, and values document for clinic participation in network
Process for scheduling follow-up appointment at community-based clinic	Centralized referral system
Patient ability to pay for buprenorphine prescription	Patient voucher for buprenorphine prescription
Extrinsic motivation to obtain/maintain X-waiver	Clinician honorariums

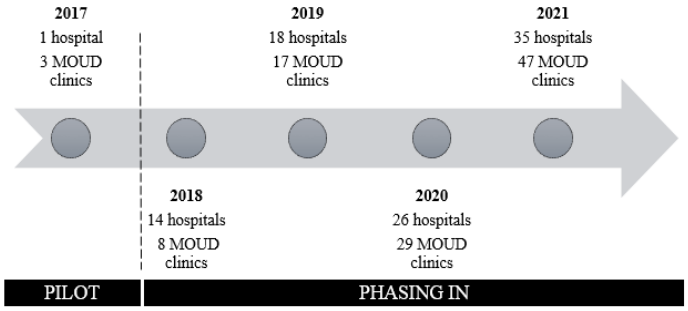

Figure 2. Timeline of implementation of the New York MATTERS* network.
**MATTERS*, Medication Treatment and Electronic Referrals network; *MOUD*, medications for opioid use disorder.

instructions via email and text message. Feedback from clinicians and patients reflected that the OLRS was faster and more user-friendly than the original referral phone line model. The OLRS also allowed for more reliable data collection because the patients or hospital staff entered data directly into the system using a combination of defined and free-text fields.

LIMITATIONS

When analyzed through the first six phases of the PRECEDE-PROCEED model, the New York MATTERS network displays many strengths for treating people with OUD with ED-initiated buprenorphine, but there are some limitations associated with this rollout. The pilot study and subsequent spread of the program took place in an area with already existing resources and infrastructure, such as clinics, pharmacies willing to participate in voucher programs, and call centers available to facilitate scheduling. These resources may not be available in all communities, which may slow, limit, or completely prevent local implementation. Clinicians' perceptions of self-efficacy and concerns regarding buprenorphine prescription were based on self-reports, which could have been caused by a social desirability bias. Additionally, the pilot study system is known for progressive healthcare and public health programming; so the buy-in may have been greater, simply because of past experiences with novel program adoption or because the system had funding for DEA X-waivers, hybrid training, and incentives. Finally, the educational and ecological assessment included the views of two emergency physicians; including additional relevant stakeholders may have yielded more robust information.

Table 3. Characteristics of organizations participating in the New York MATTERS* network

Type or organization	Number of organizations
Hospitals	--
Teaching community	10
Nonteaching community	24
Federal government	1
Community-based MOUD clinics	--
Single site	31
Multisite: 2-4 locations	14
Multisite: 5+ locations	2
Retail community pharmacies	--
Local/independent	20
Chain	2

**MATTERS*, Medication Treatment and Electronic Referrals network; *MOUD*, medications for opioid use disorder.

CONCLUSION

New York State's Medication Treatment and Electronic Referrals network provides compelling evidence that ED-initiated buprenorphine as a public health approach to addressing the opioid epidemic[20] can be expanded into a scalable intervention model, operating through a broad network of hospitals and community-based clinicians. This review provides evidence that the financial burden of providing medications for opioid use disorder can and should be addressed through these types of interventions. Data collection efforts regarding patients' health and quality of life are ongoing. Further research is needed to examine the effects of the New York MATTERS network intervention on long-term outcomes for these patients with opioid use disorder who present to the ED. As the network expands into new regions, future study is needed to examine the scalability and the generalizability of this intervention.

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Improving Uptake of Emergency Department-initiated Buprenorphine: Barriers and Solutions

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Emergency departments (ED) are increasingly providing buprenorphine to persons with opioid use disorder. Buprenorphine programs in the ED have strong support from public health leaders and emergency medicine specialty societies and have proven to be clinically effective, cost effective, and feasible. Even so, few ED buprenorphine programs currently exist. Given this imbalance between evidence-based practice and current practice, proven behavior change approaches can be used to guide local efforts to expand ED buprenorphine capacity. In this paper, we use the theory of planned behavior to identify and address the 1) clinician factors, 2) institutional factors, and 3) external factors surrounding ED buprenorphine implementation. By doing so, we seek to provide actionable and pragmatic recommendations to increase ED buprenorphine availability across different practice settings. [West J Emerg Med. 2022;23(4)461–467.]

INTRODUCTION

Medical treatment for opioid use disorder (OUD) with opioid agonists decreases opioid-specific and all-cause mortality,[1] human immunodeficiency virus, and hepatitis C transmission,[2] as well as interactions with the criminal justice system.[3] Although methadone and buprenorphine, referred to as medication for opioid use disorder (MOUD), are widely recognized to be the most efficacious therapy,[4] there is a significant treatment gap.[5] With nearly all (96%) states lacking the capacity to provide MOUD to all appropriate patients,[6] there is a vital need to improve access for those with OUD who are seeking treatment.

Emergency departments (ED) often serve as the primary access to medical care for underserved populations[7] and have an essential role in facilitating linkage to the healthcare system and addressing health disparities.[8] Although addiction treatment has traditionally been perceived to be outside the scope of emergency medicine, emergency physicians (EP) commonly treat patients with OUD, many of whom are often disenfranchised, marginalized, and have less reliable access to healthcare. Expanding the scope of emergency medicine to include initiation of addiction treatment is essential because the ED is where these patients present.[9,10,11]

Emergency departments are caring for increasing numbers of people with OUD, particularly after an opioid overdose.[10] Unfortunately, the COVID-19 pandemic has accelerated this phenomenon by interrupting established outpatient behavioral health resources/clinics.[12,13] In the year following an opioid overdose the risk of death exceeds that of other commonly treated ED conditions including chest pain and syncope.[14,15] Recognizing the key role of the ED in the healthcare system, some EDs have developed programs to provide ED buprenorphine and linkage to outpatient MOUD treatment by identifying gaps in treatment access.[16,17,18,19] Buprenorphine initiated in the ED is associated with increased retention in addiction treatment, decreased rates of self-reported illicit

opioid use, and increased cost effectiveness when compared to nonpharmacologic interventions.[16,20] These programs have had considerable success and enjoyed strong support from specialty societies[21] and national public health leaders.[11] Even so, adoption of ED buprenorphine programs has been very limited. In 2017, more than 47,000 individuals died of opioid overdose, yet only 5% of EDs offered buprenorphine.[22,23]

Barriers and facilitators to implementation of ED buprenorphine treatment have been described previously.[24,25] The ongoing buprenorphine treatment gap demonstrates the need to offer solutions beyond exploring barriers to ED buprenorphine to meaningfully improve access to care. Given that modifying clinical behaviors and organizational practice can be difficult, slow, and resource intensive,[24,26] the gap between evidence-based care and clinical practices necessitates novel and creative approaches to change treatment paradigms. Theoretical models of behavioral change are increasingly being used to effectively guide program implementation and have the potential to more expediently transform clinical practice.[27,28] Here, we use the theory of planned behavior (TPB) to provide guidance in facilitating implementation and adoption of ED buprenorphine initiatives through actionable recommendations to address pivotal individual, organizational, and external barriers.

Population Health Research Capsule

What do we already know about this issue?
Emergency department (ED) buprenorphine is an evidenced-based treatment for opioid use disorder, yet too few EDs offer this important therapy.

What was the research question?
Can theoretical models of behavior change help facilitate the increased adoption of ED buprenorphine?

What was the major finding of the study?
Theoretical models of behavior change can help more effectively guide efforts to increase ED buprenorphine.

How does this improve population health?
Expanding access to ED buprenorphine is essential to providing more effective and equitable care to an underserved and marginalized patient population.

CONCEPTUAL FRAMEWORK

Our conceptual framework is based upon TPB, a well-established theory of behavioral change used to describe, predict, and modify human behavior for more than 30 years.[29] The TPB postulates that behavioral intentions are determined by a person's attitudes, local norms, and perceived control over a given behavior.[30] By extension, TPB proposes that the intention to perform any behavior is influenced by 1) personal preference and/or bias, 2) whether or not others in your environment perform the behavior, and 3) the ease (or lack thereof) of performing the behavior. Although there are a multitude of behavioral change theories, TPB is recognized as one of the preeminent frameworks of behavioral change and has a demonstrated track record of effectively promoting the adoption of evidence-based physician decision-making.[31,32,33] As a clinical intervention that is evidence-based yet lacking in widespread implementation, ED buprenorphine initiatives would benefit from the application of TBP.

The theory of planned behavior has demonstrated utility in altering the clinical behaviors of emergency physicians. It has been used to understand and contextualize the relative uptake of computed tomography clinical imaging rules[34] and has also been used to design clinical curriculums that successfully modified the behavioral intentions of EPs.[35] More recently, Samuels et al and Choo et al used TPB as a framework to inform changes in opioid-related clinical behaviors among clinicians in the ED.[36,37]

Although the theory is well known to behavioral psychologists, EPs may be less familiar with it. To provide a more pragmatic and tangible conceptual framework for emergency medicine, we engaged in a deliberative and iterative process to reframe the principles of TPB into 1) clinician factors, 2) institutional factors, and 3) external factors that influence ED buprenorphine program adoption and implementation (Figure 1). This process used three rounds of live discussion, collaboration, and debate, all held over a virtual videoconferencing platform. The proposed theoretical foundation underwent multiple revisions as we sought to maximize its validity and practical applicability. At the end of this process, each author agreed with the chosen theoretical framework. Our conceptual framework mirrors the original conception of TPB and is further informed by our experiences as EPs and administrators of ED buprenorphine programs. We believe that this conceptual approach is appropriately grounded in behavioral change theory but better reflects the unique experiences and demands in EDs.

CLINICIAN FACTORS

The first step in implementing any new treatment is overcoming clinician-level barriers to adoption, which hinges on individual clinicians concluding that doing this is right for patients. Currently, most EPs do not feel prepared to discuss MOUD with patients.[38] Educational efforts should highlight the devastating outcomes associated with untreated OUD and nonfatal overdose in ED patients: recent studies

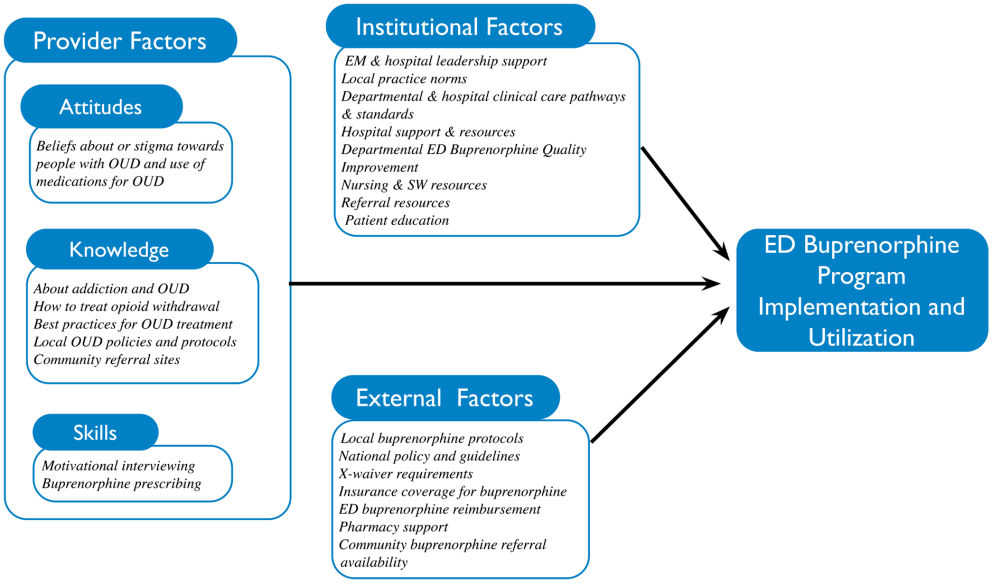

Figure 1. Conceptual diagram.
ED, emergency department; *EM,* emergency medicine; *OUD,* opioid use disorder.

have demonstrated between 1 in 8 and 1 in 18 patients who present to the ED with nonfatal overdose die within one year, a mortality rate exceeding that of myocardial infarction and congestive heart failure, which is even more alarming when considering that many of these preventable deaths often occur in young, otherwise healthy people.[14,15]

A foundational hurdle in advancing MOUD is overcoming the stigma surrounding addiction and addiction treatment. For generations, addiction has been viewed as a consequence of bad choices resulting from a failure of morals or willpower, instead of being recognized as a disease of altered brain chemistry driven primarily by genetic and environmental factors.[39,40] These socially discrediting attitudes are reinforced by laws and regulations in the United States that criminalize recreational drug use and sequester addiction medicine away from the treatment of every other disease.[41,42] Stigma can be overcome using education, language, and action.

To correct widely repeated untruths such as "buprenorphine replaces one addiction with another" and counter misperceptions about substance use and evidence-based treatment, education is essential. Education can address knowledge gaps regarding the efficacy and effectiveness of medication-based addiction treatment to save lives and return people with OUD to function and health. Replacing stigmatizing language (eg, addict, junkie, user) with person-centered, humanizing language (eg, person with addiction, person with substance use disorder) has a self-perpetuating effect within a department and can contribute to the culture shift often required for success (Table).[43] These skills and attitudes are effectively taught in classes and workshops, some of which are publicly available; a particularly powerful approach is to ask patients with lived experience to share their stories or use standardized patient actors in an OUD simulation session that allows clinicians to confront their biases and knowledge gaps in a controlled, supportive environment.[44]

Perhaps the most effective way to overcome stigma within a department is to start treating OUD with evidence-based treatment available in EDs, namely buprenorphine. Anecdotally, the immediate feedback loop of watching patients who present in significant distress from withdrawal experience substantial improvement with appropriate treatment can have a meaningful impact on ED staff and operations. Many EPs feel that they lack the knowledge and skills to identify patients who would benefit from ED-initiated buprenorphine and successfully initiate treatment.[24,46] This uncertainty likely arises from a lack of education on buprenorphine's pharmacology, and the unusual regulations that, until recently, governed its prescription.

Buprenorphine prescription previously required an eight-hour training for physicians and a 24-hour training for nurse practitioners and physician assistants to obtain a Drug Addiction Treatment Act of 2000 (DATA 2000 X) waiver. Recently, the US Department of Health and Human Services (HSS) published new practice guidelines, which exempts clinicians who treat up to 30 patients with buprenorphine from X-waiver training and other requirements pertaining to counseling and ancillary services.[47] Although enrolling in a waiver training course is an excellent way to gain expertise

Table. Replacing stigmatizing language, taken and adapted from the National Institute on Drug Abuse.[45]

Avoid	Employ	Why
• Addict • User • Substance or drug abuser • Junkie • Alcoholic • Drunk • Former addict • Reformed addict	• Person with substance use disorder • Person with OUD or person with opioid addiction (when substance in use is opioids) • Patient • Person with alcohol use disorder • Person who misuses alcohol/engages in unhealthy/hazardous alcohol use • Person in recovery or long-term recovery • Person who previously used drugs	• Person-first language. • The change shows that a person "has" a problem rather than "is" the problem. • The terms avoid negative associations, punitive attitudes, and individual blame.
• Habit	• Substance use disorder • Drug addiction	• Inaccurately implies that a person is choosing to use substances or can choose to stop. • "Habit" may undermine the seriousness of the disease.
• Abuse	For illicit drugs: • Use For prescription medications: • Misuse • Used other than prescribed	• The term "abuse" is associated with negative judgments and punishment. • Legitimate use of prescription medications is limited to their use as prescribed by the person to whom they are prescribed. Consumption outside these parameters is misuse.
• Opioid substitution replacement therapy	• Opioid agonist therapy • Medication treatment for OUD • Pharmacotherapy	• It is a misconception that medications merely "substitute" one drug or "one addiction" for another.

OUD, opioid use disorder.

in using buprenorphine, the legislated training requirement created an unintended barrier.[48,49,50] Now, departments can successfully implement effective OUD treatment and ED-initiated buprenorphine by having clinicians register with the Substance Abuse and Mental Health Services Administration to treat 30 or fewer patients at a time.

Clinicians may be reluctant to administer buprenorphine for fear of inducing worsening withdrawal symptoms, an important consideration given buprenorphine's high-affinity, partial-agonist pharmacology. However, a targeted history and simple assessment can verify the severity of withdrawal using the Clinical Opioid Withdrawal Scale (COWS) to prevent buprenorphine-precipitated withdrawal.[51] These validated clinical scoring tools can be incorporated into electronic health record (EHR) systems to maximize EPs' use of and clinical familiarity with buprenorphine, as well as improve communication between clinicians. Patients who have been using methadone are particularly susceptible to buprenorphine-precipitated withdrawal and should not be treated with buprenorphine for 3-5 days after their last dose, and not without a convincingly high COWS score. Emergency department-precipitated withdrawal is a rare event, observed in <1 in a large case series.[52] Furthermore, in many instances buprenorphine-precipitated withdrawal is effectively treated with higher doses of buprenorphine.[53] The same approach can be considered in the particularly high-risk group of patients presenting with naloxone-precipitated withdrawal after overdose, who can be given buprenorphine both to relieve withdrawal symptoms and protect them from the toxicity of full agonist opioids, although the evidence for this approach is limited.[54]

Emergency clinicians work in a time-stressed environment and may perceive ED-initiated buprenorphine as a burdensome additional task. However, treatment of opioid withdrawal syndrome with non-agonists (eg, clonidine, promethazine) is less effective and may lead to a protracted ED stay. Patients in severe withdrawal who are treated with buprenorphine will experience rapid relief while simultaneously initiating highly effective treatment for OUD, often without the need to place an intravenous line. Furthermore, by offering tools to effectively manage a patient population that is often perceived as "difficult," developing proficiency and confidence in treating OUD improves clinician knowledge.[55]

INSTITUTIONAL FACTORS

On an institutional level, several factors can facilitate the development of an effective program to initiate buprenorphine in the ED. Although there is no single "recipe," successful programs share several key components; these include the presence of 1) at least one local champion, 2) departmental leadership support, 3) a site-specific protocol, and 4) a clear referral pathway for linkage to outpatient treatment. Many programs also have additional components that support implementation including onsite support staff (social workers and/or patient navigators), screening questions for substance use disorders, clinical decision support pathways which may

be integrated with the EHR, and robust quality improvement programs that include feedback on patient linkage to treatment on an individual and group level.[24,25,38,46]

Widespread practice change within a department depends on normalizing institutional best practice expectations and demonstrating that our peers are doing this. A trusted department champion who is willing to provide close to real-time support to clinicians on shift who have questions or concerns can be a powerful tool in closing the local treatment gap. Additionally, leveraging departmental leadership support can be effective. Clear evidence of departmental and institutional support is recognized as among the most important components to building successful programs because leadership philosophy and priorities guide clinical practice, quality improvement priorities, and resource allocation.[24] Departmental leadership can also be critical to reducing stigma by supporting education on addiction and buprenorphine to clinicians, nurses, techs, social workers, pharmacists, and other ED staff who play an important part in supporting ED OUD treatment. Leadership can facilitate adoption of ED-initiated buprenorphine by providing buprenorphine education specific to the ED setting.[56,57]

The overall objective of ED buprenorphine programs is to streamline the delivery of evidence-based care for OUD by minimizing additional clinician effort and workflow disruption through the development of site-specific protocols and referral pathways. Departmental protocols and care pathways are widely used to standardize the delivery of high-quality care for ED patients with sepsis, acute coronary syndromes, and stroke. Protocols effectively set the standard of care for an ED based on the best evidence to date, are agreed upon by local experts and departmental leadership, and typically align with quality measures or best practices as determined by the Centers for Medicare and Medicaid, the American College of Emergency Physicians (ACEP), and other organizations. Furthermore, protocols reduce the cognitive load of clinicians by providing eligibility criteria and direction about patient selection, clinical management, and follow-up. Adapting one of many published ED-specific initiation pathways[58,59] to local operations can help overcome apprehension related to inexperience or unfamiliarity with buprenorphine, decrease treatment variability, and mitigate the stigma for patients who are receiving treatment for substance misuse.

One of the most common concerns about initiating buprenorphine in the ED is the lack of outpatient resources to provide ongoing care.[38,46] Identifying local outpatient treatment resources and establishing reliable referral pathways is a critical role of the local champion, as the optimization often requires an ongoing relationship with key stakeholders at local clinics. These relationships are vital early in the process to provide bidirectional feedback, troubleshoot challenges, and address the needs of patients, EPs and outpatient professionals. Stakeholder input and clinical practice has guided the integration of protocols and clinician decision support in many EDs and has prompted the exploration of automated referrals into the EHR.[60] A pilot test of a user-centered clinical decision support tool integrated within the EHR more than doubled rates of ED-initiated buprenorphine and naloxone prescribing, and almost doubled the number of physicians who prescribed MOUD.[61,62]

EXTERNAL FACTORS

Federal, state, and local policies outside the hospital and ED also determine whether EPs can provide buprenorphine without difficulty. Key external considerations include prescribing regulations and restrictions, insurance coverage of medications, reimbursement, outpatient treatment availability, and community pharmacy practices. Until recently, buprenorphine was one of the most tightly federally regulated prescription medications in the US.[47] The recent decision by the HHS to exempt certain clinicians from the full X waiver training is a laudable step toward expanding access to buprenorphine and addiction treatment. Nonetheless, it is important to understand the extent to which previous federal requirements created significant limitations to buprenorphine treatment access, particularly in rural areas.

Approximately 40% of US counties do not have a buprenorphine prescriber, and significant socioeconomic disparities exist in access to buprenorphine and methadone treatment.[6,63,64,65,66] Although a critical step, X waiver exemptions may not translate into increased buprenorphine access if physicians are reticent to prescribe a medication with which they have had minimal previous experience. Given the recent changes in X waiver training requirements, emphasis should be placed on focused training and decision support for clinicians inexperienced in its use. Additionally, some institutions have developed additional "bridge clinics" that address outpatient gaps by stabilizing patients on an initial buprenorphine regimen and facilitating linkage to comprehensive outpatient treatment.[67] Telehealth addiction treatment is an evolving care solution that could be used to address the OUD treatment gap and has gained traction during the COVID-19 epidemic, but it has not yet been widely available or implemented.[68,69,70,71,72]

Patients' ability to access prescribed buprenorphine is influenced by medication cost and the policies of their local pharmacies. For patients lacking insurance, out-of-pocket costs can be prohibitive.[73] Depending on insurance coverage, prescribing buprenorphine monotherapy (vs buprenorphine/naloxone) may help decrease these costs. Some insurers require prior authorization for buprenorphine prescriptions, although this practice is prohibited in some states.[74,75] Finally, the availability of buprenorphine at local pharmacies can affect access following ED discharge. Barriers to provision include medication stocking, ability to verify a prescriber's X waiver, and pharmacist stigma.[76,77,78] Developing relationships with local pharmacies may facilitate access and help guide patients to a pharmacy where they can successfully fill prescriptions.

Modifying existing reimbursement structures is another avenue through which EPs, professional societies, and government regulators can influence implementation of ED buprenorphine. There are numerous existing examples of reimbursable clinical actions that support ED buprenorphine. For instance, Screening, Brief Intervention, and Referral to Treatment is frequently used in conjunction with buprenorphine initiation and is reimbursable by Medicare and many state Medicaid programs.[79] Furthermore, some state Medicaid offices will also reimburse for peer recovery specialists to help engage patients and support seeking treatment and coordinate linkage to outpatient care.[80]

At the national level, there is evidence that payers increasingly value ED buprenorphine initiatives. In the 2020 Centers for Medicare and Medicare Services (CMS) proposed Physician Fee Schedule,[81] CMS requested comment about whether ED initiation of buprenorphine and referral to treatment should be eligible for separate payment. These encouraging, albeit modest, signs that reimbursement systems will reward ED buprenorphine programs highlights the need for ongoing advocacy from our professional societies. To this end, ACEP has advocated for separate payment of ED buprenorphine initiation, which would incentivize and expand provision of buprenorphine in the ED.[82] Moving forward, EM professional societies should insist on providing fair and effective reimbursement for such critical clinical interventions.

State and national EM, public health, and treatment organizations have developed strategies to support ED buprenorphine initiation.[83,84] Some cities and states have implemented incentive programs,[85,86] policy guidance,[87,88] or legislative or regulatory requirements.[89,90] Within EM, ACEP partnered with the American Academy of Addiction Psychiatry to produce buprenorphine training tailored to EM,[91] ED-buprenorphine clinical support applications,[92] and a quality improvement initiative, the Emergency Quality Network Opioid Initiative.[93] These resources provide online educational content as well as quality metric reporting to support participating community and academic EDs to improve care for people with OUD.

DISCUSSION

Using established theory-based models of behavioral change can help identify and address common barriers to building buprenorphine initiation programs in the ED. Informed by our experiences and content expertise, we identified clinician, institutional, and external factors that can promote clinician initiation of ED buprenorphine to treat OUD and opioid withdrawal. Our proposed framework supports recent efforts to use theoretical models of behavioral change to more effectively understand and modify opioid-related ED clinical practices.[36,37]

Our approach identifies numerous pragmatic solutions that have the potential to meaningfully increase ED buprenorphine use. Tackling clinician barriers will require personal and professional commitments to the concept that providing buprenorphine initiation is right for our patients. This requires deliberate efforts to reframe language around substance use disorders, improve clinical familiarity with buprenorphine through targeted education and clinical practice interventions, and accept responsibility to decrease the profound stigma associated with treatment. Institutions can support this process by normalizing the process of ED buprenorphine initiation and provide feedback to show that our peers are doing this. Celebrating local champions, promoting effective departmental leadership, establishing departmental guidelines/protocols, and exploring operational interventions to maximize efficiency are just some of the strategies that EDs can employ to this end. Finally, the EM community at large should engage in the legal, sociopolitical, and economic arenas that can facilitate the ability to provide life-saving, evidence-based treatment with buprenorphine. These efforts were instrumental to the recent regulatory shift and offer hope that a permanent legislative fix is feasible with continued engagement and advocacy. From strengthening relationships with local pharmacies to supporting the expansion of substance use disorder treatment in all forms, the EM community should take action to reduce external barriers to allow our clinicians to provide buprenorphine without difficulty.

These recommendations collectively form a comprehensive roadmap, guided by behavioral change theory, to improve ED buprenorphine availability. Although there are many interventions that are likely to help increase ED treatment capacity, the most effective strategy may be one that is multi-faceted, addresses multiple domains, and fits the context of local EDs. These behavioral interventions may be synergistic in nature, and a diversity of interventions may be required to meaningfully increase access to buprenorphine depending upon the practice setting. It is also important to acknowledge that certain EDs may not have the institutional resources to implement some of the more resource-intensive recommendations outlined here. In these instances, it is important to focus on interventions that are obtainable given local resources to build momentum. Given the persistence of the MOUD treatment gap, thoughtful approaches to ED buprenorphine expansion are needed now more than ever.

The most important directions for future study concern which interventions are most effective at promoting ED buprenorphine program adoption, how to effectively implement them at a variety of practice sites, and how to sustain these programs. Most published interventions to date have focused on proving effectiveness and have not attempted to comprehensively address implementation. Finally, this theoretical approach has potential relevance to other EM clinical arenas that are struggling with implementing behavior change.

LIMITATIONS

This approach has limitations that warrant consideration. Our application of a theoretical model of

behavioral change toward ED buprenorphine exclusively uses a single theoretical framework. As evidenced in the process of identifying a specific conceptual framework, there were significant challenges in finding a single model of behavioral change that all authors could relate to. Our work does not intend to suggest that other models of behavior change are less useful in changing attitudes about ED buprenorphine. Additionally, this model is based upon the theory of planned behavior but, albeit intentionally, it is not an exact application of TPB. Our framework does not test the predictive ability of the various TPB constructs, nor does it provide conclusive evidence as to which intervention is most effective. Future research should study the relative effectiveness of various approaches to facilitate ED buprenorphine program implementation.

CONCLUSION

Initiation of buprenorphine in the ED is an evidence-based treatment for opioid use disorder that must be broadly implemented to address current treatment gaps. A theory of planned behavior approach can identify and offer solutions to common personal, institutional, and external barriers to ED buprenorphine program implementation. Future investigations should examine the effectiveness of interventions specifically guided by behavioral change theory.

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Please see supplemental file.

Clue Cells on Vaginal Wet Preparation Are Not Associated with Urinary Tract Infections or Positive Urine Cultures

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Introduction: Clue cells result from aberrant vaginal microflora and are associated with an increased vaginal pH, which can allow colonization of uropathogens in the vaginal introitus, increasing the risk for urinary tract infections (UTI). We sought to determine whether clue cells on vaginal wet preparation in the emergency department (ED) are associated with emergency physician diagnoses of UTIs and positive urine cultures.

Methods: We conducted a retrospective analysis examining a dataset of women (≥18 years of age) who received both a genital wet preparation and urine testing in the ED. Both chi-square and multivariable regression analysis were performed.

Results: We analyzed 14,952 encounters. On both univariable and multivariable analyses, emergency physicians diagnosed significantly fewer clue cell-positive women with a UTI (10.9% diagnosed with UTI vs 13.1% without UTI) (P <.001). Women with clue cells on vaginal wet preparation were not more likely to have a positive urine culture or have a urine culture growing *Escherichia coli*. Pregnant women with clue cells on vaginal wet preparation were not more likely to have a UTI or have a positive urine culture.

Conclusion: Emergency physicians diagnosed significantly fewer women with UTIs when they found clue cells on vaginal wet preparation. Clue cells on vaginal wet preparation were not associated with an increased likelihood of a positive urine culture or having *E. coli* growing in the urine. [West J Emerg Med. 2022;23(4)468–472.]

INTRODUCTION

Genitourinary tract infections, especially urinary tract infections (UTI), are common in the emergency department (ED).[1] Emergency physicians frequently perform vaginal wet preparation on women with genitourinary complaints, especially when there are concerns of vaginitis or sexually transmitted infections (STI). Vaginal wet preparation results can help risk-stratify ED patients for STIs.[2]

Bacterial vaginosis (BV) is the most common cause of vaginitis in outpatient medicine and results when anaerobic bacteria replace the normal lactobacilli colonizers of the vagina.[3] Clue cells are vaginal epithelial cells covered in bacteria from an overgrowth of *Gardnerella vaginalis*, *Mycoplasma hominis*, *Mobiluncus* species, and *Peptostreptococcus* species.[3] Clue cells on wet preparation represent a disruption of the vaginal microbiome and have about a 53-90% sensitivity and 40-100% specificity for BV.[4] Some of the risk factors for BV overlap with UTI, including frequent sexual activity, use of spermicide, alterations of vaginal flora, and vaginal douching.[3,5] Previous studies suggest

that BV is associated with both UTI and positive urine culture.[6-11] Some propose that a higher vaginal pH and fewer lactobacilli found with BV allow uropathogens to thrive in the vaginal introitus leading to increased risk for UTI and bacteriuria.[12,13] Women with recurrent UTIs are more likely to have vaginal coliform bacteria, and this colonization often precedes bacteriuria.[14]

We sought to determine whether the presence of vaginal clue cells was associated with a diagnosis of UTI in the ED, and secondarily whether vaginal clue cells were associated with having a positive urine culture, having a urine culture grow *Escherichia coli*, and being diagnosed with a UTI while having a positive culture. We also examined these associations in pregnant women.[6,7,10]

METHODS

We performed a secondary analysis of an existing dataset of ED encounters (N = 75,000) where patients ≥18 years of age received testing for gonorrhea, chlamydia or trichomonas, or received a urinalysis and urine culture. All ED visits occurred at University Hospitals between April 18, 2014–March 7, 2017. The dataset was created by University Hospitals information technology by extracting data from the institution's electronic health records. For our study, we excluded men, women without a genital clue-cell result, and women without a urinalysis or a urine culture (Supplement 1). Data has previously been published from this dataset.[2,15-21] The Mayo Clinic institutional review board provided an exemption from full review.

We categorized patients as being diagnosed with a UTI if they had a specific ED *International Classification of Diseases* (ICD) code (Supplement 1). We classified women as pregnant if they had a pregnancy-related ICD code or had a positive pregnancy test in the ED. For the urinalysis, we report the mean number of red blood cells (RBC) and white blood cells (WBC) if a range was provided, and all cells/high powered field (HPF) ≥101 were recoded as 101 cells/HPF. For the urine culture, we categorized urine cultures as positive (≥10,000 colony-forming units per milliliter [CFU/mL]), negative (0-10,000 CFU/mL), or not performed. Neither Amsel's nor Nugent's criteria for BV could be determined because no vaginal "whiff test," Gram stain, or pH were recorded.

STATISTICAL ANALYSIS

Categorical variables are presented as counts and percentages with chi square used to test associations. Continuous variables are presented as median and interquartile range with two-sample t-tests used to test associations. Multivariable logistic regression analysis was performed using clue cells as the dependent variable. We calculated odds ratios (OR) and 95% confidence intervals from the multivariable model. A *P*-value <.05 was considered statistically significant. Statistical analyses were conducted with statistical software JMP Pro 14 (JMP Statistic Discovery LLC, London, Ont, Canada) and SAS version 9.4 (SAS Institute, Inc. Cary, NC).

RESULTS

There were 14,952 encounters included in the analysis (Supplement 1). We summarize patient characteristics and laboratory findings in Table 1. After adjusting for demographics and urinalysis, women with positive clue cells on vaginal wet preparation were significantly less likely to be diagnosed with a UTI (n = 707 [10.9%] vs n = 1115 [13.1%]; OR .75 [.66-.85]; *P* <.001) (Tables 1 and 2).

Table 1. Encounter characteristics.

	Total (N = 14,952)
Age (years), median (IQR)	26 (22.2, 32.4)
Black/African American, n (%)	13,191/14,890 (88.6%)
Marital status married/life partner, n (%)	1,389/14,910 (9.3%)
Pregnant, n (%)	3,298 (22.1%)
Discharged from ED, n (%)	14,062 (94.0%)
Neisseria gonorrhea NAAT positive, n (%)	436/14,556 (3.0%)
Chlamydia trachomatis NAAT positive, n (%)	1,146/14,544 (7.9%)
Trichomonas vaginalis NAAT positive, n (%)	371/4,428 (8.4%)
Red blood cells, n; median (IQR)	10,712; 2.5 (2.0, 12.5)
White blood cells, n; median (IQR)	10,714; 5.0 (2.5, 13.0)
Wet prep-clue cells present, n (%)	6,469 (43.3%)

IQR, interquartile range; *ED*, emergency department; *NAAT*, nucleic acid amplification test; *WBC*, white blood cell; *CFU*, colony-forming units; *mL*, milliliter; *E. coli*, Escherichia coli.

Table 1. Continued.

	Total (N = 14,952)
Wet prep-yeast cells present, n (%)	949/14,739 (6.4%)
Bacteria present, n (%)	6506/10,730 (60.6%)
Blood present, n (%)	5848/14,770 (39.6%)
Leukocyte esterase present, n (%)	6753/14,760 (45.8%)
Mucous present, n (%)	6314/10,722 (58.9%)
Nitrite positive, n (%)	558/14,861 (3.8%)
pH, n; median (IQR)	14,865, 6.0 (5.0, 6.0)
Protein present, n (%)	4341/14,850 (29.2%)
Urobilinogen (2.0+), n (%)	3604/14,865 (24.2%)
WBC clumps present, n (%)	476/10,623 (4.5%)
Yeast in urine present, n (%)	284/10,667 (2.7%)
Urine culture CFU/mL ≥10,000, n (%)	893/4,505 (19.8%)
Diagnosed with a urinary tract infection (UTI) in the ED, n (%)	1,822 (12.2%)
Urine culture positive, n (%)	358/965 (37.1%)
E.coli-positive urine culture, n (%)	562/878 (64.0%)

IQR, interquartile range; *ED*, emergency department; *NAAT*, nucleic acid amplification test; *WBC*, white blood cell; *CFU*, colony-forming units; *mL*, milliliter; *E. coli*, Escherichia coli.

Table 2. Multivariable regression model examining the association of vaginal clue cells on vaginal wet preparation.

Variable	OR (95% CI)	P-value
Age (years)	0.99 (0.99, 1.00)	<0.001
Black/African American (vs other)	2.17 (1.89, 2.50)	<0.001
Married/life partner (vs. other marital status)	0.77 (0.66, 0.90)	<0.001
Pregnant (vs not pregnant)	0.93 (0.84, 1.03)	0.16
Urine:		
Bacteria (0-4+)	1.17 (1.13, 1.22)	<0.001
Blood (0-3+)	1.05 (1.00, 1.09)	0.04
Leukocyte esterase (0-3+)	1.02 (0.97, 1.06)	0.52
Mucus (0-4+)	0.94 (0.92, 0.97)	<0.001
pH (5-9)	1.03 (0.99, 1.08)	0.17
RBCs (0-101 cells/HPF)	0.99 (0.99, 0.99)	<0.001
WBCs (0-101 cells/HPF)	1.00 (1.00, 1.00)	0.65
WBC clumps present (vs. absent)	1.09 (0.88, 1.35)	0.45
Nitrite positive (vs. absent)	1.11 (0.92, 1.34)	0.29
Protein positive (vs. negative)	1.31 (1.20, 1.44)	<0.001
Trichomonas present (vs. absent)	1.31 (1.01, 1.70)	0.04
Diagnosed with a UTI (vs. no UTI diagnosis)	0.75 (0.66, 0.85)	<0.001
Urine culture ordered (vs. no urine culture done)	0.85 (0.78, 0.93)	<0.001

OR, odds ratio; *CI*, confidence interval; *RBCs*, red blood cells; *HPF*, high powered field; *WBCs*, white blood cells; *UTI*, urinary tract infection.

On univariable analysis, the secondary outcomes of women with clue cells on vaginal wet preparation, compared to those without clue cells:

1. if diagnosed with a UTI, were not more likely to have a positive urine culture (n = 123; 36.0%) vs (n = 235; 37.7%), respectively (OR .93 [.71-1.22]; *P* =.59).

2. if pregnant, were not more likely to be diagnosed with a UTI (n = 93; 6.6%) vs (n = 143; 7.6%), respectively (OR .87 [.66-1.13]; *P* =.29).

3. if pregnant and diagnosed with a UTI, were not more likely have a positive urine culture (n = 9; 17.6%) vs (n = 24; 27.0%), respectively (OR .58 [.25-1.37]; *P* =.21).

4. if pregnant, were not more likely to have a positive urine culture (n = 60; 14.3%) vs (n = 94; 16.2%), respectively (OR .87 [.61-1.23]; *P* =.43).

After adjusting for demographics and urinalysis we found that patients with vaginal clue cells were significantly less likely to have a urine culture performed (OR .85 [.78-.93]; *P* <.001) (Table 2). A clinical diagnosis of UTI was not a significant effect modifier of the association between vaginal clue cells and a positive urine culture (*P* = .72) (Supplement 2). Vaginal clue cells were not associated with having a urine culture of ≥10,000 CFU/mL bacteria (vs <10,000 CFU/mL) (OR 0.95 [0.79-1.16]; *P* = 0.64), nor with having a urine culture growing *E coli* (vs non-*E. coli*) (OR 1.15 (.73-1.61); *P* =. 41) (Supplement 3). Pregnancy was not a significant effect modifier of the association between wet prep clue cells and UTI (*P* = .67) or a positive urine culture (*P* = .10) (Supplement 2).

DISCUSSION

Our data does not support the hypothesis that clue cells, which reflect a dysregulated vaginal microbiome, are associated with an increased risk for UTI or positive urine culture in the ED. Other studies finding BV to be associated with UTI included using bacteriuria as sole surrogate marker for UTI,[11] focusing on pregnant women,[6,10] examining women from gynecology clinics,[6-8,11] or outside the United States[6,9-11] where practice patterns may differ, or only used univariable statistics.[6,7,9,11] Our findings appear unique in the medical literature, which could be related to the ED practice environment or to the more advanced analyses we present.

Our analysis does present a possible alternate cause for this finding. Not all women diagnosed with a UTI received a genital wet preparation or a urine culture, and not all women with a genital wet preparation received a urinalysis or urine culture, demonstrating selection bias (Supplement 1). Emergency physicians may have limited further testing after discovering clue cells on wet prep, prematurely anchoring and disregarding the possibility of concurrent BV and UTI. Clinicians were significantly less likely to order a urine culture when vaginal clue cells were identified, which supports this as a possible alternate explanation for our findings.

LIMITATIONS

Our analysis did not include vaginal pH or vaginal uropathogenic culture results, and we could only use the presence of clue cells to identify the presence of a dysregulated vaginal microbiome.[22] Neither Amsel's nor Nugent's criteria were available for analysis, and we did not compare our outcomes of interest to women diagnosed clinically with BV. Because we did not have the patients' past medical histories of UTIs or any longitudinal data, we could not determine whether women with vaginal clue cells were more likely to get recurrent or future UTIs. Urinary tract infections and asymptomatic bacteriuria are frequently misdiagnosed and incorrectly treated in the ED, which could have affected the validity of the study findings, especially since our definition of a UTI was the ED diagnosis. One study found that BV was only associated with *E. coli* UTI in women who used a diaphragm, but our dataset did not include methods of contraception.[14]

CONCLUSION

Previous studies identified a dysregulated vaginal microbiome to be associated with an increased risk for UTI. However, we found that vaginal clue cells in the ED were associated with a significantly reduced risk of being diagnosed with a UTI. Vaginal clue cells in the ED were not associated with an increased likelihood of having a positive urine culture, having a urine culture growing *E coli*, being diagnosed with a UTI and having a positive urine culture, being pregnant and having a UTI, or being pregnant with a positive urine culture.

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Clinical Features of Aortic Dissection in the Emergency Department: A Single-center Experience from South China

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Objectives: Our goal in this study was to determine 1) whether there are any differences in clinical characteristics between Chinese and Western patients with aortic dissection (AD), and 2) the mortality rate of AD patients in the emergency department (ED) and identify the risk predictors for death.

Methods: We retrospectively analyzed patients who were diagnosed with AD and admitted to our ED between September 1, 2017–August 31, 2020. Data on age, gender, clinical manifestation, medical history, routine blood tests, liver and kidney function, coagulation, myocardial enzymology, and mortality were collected.

Results: We enrolled 535 AD patients (422 men and 113 women) with a mean age of 54.7±14.1 years. Type A AD constituted 40% of the total number of AD cases, while type B AD constituted 60%. The proportion of those who were females, 10-92 years, with type A AD, and hypertension in the Chinese population was lower than that in the Western population ($P < 0.05$ for all). Type A AD patients had a higher proportion of acute AD clinical manifestations than did patients with type B AD ($P = 0.0084$, $P < 0.05$). The mortality rate of type A AD patients (10.75%) was higher than that of type B AD patients (1.87%) ($P < 0.0001$) in the ED. Higher values of white blood cells, neutrophils, high-density lipoprotein, activated partial thromboplastin time, and D-dimer level with worsened hepatic and renal function were found in the deceased group, and multivariate logistic regression revealed that blood urea nitrogen (BUN) levels ($P = 0.0031$, $P < 0.05$) were significantly associated with death.

Conclusion: In South China, patients with AD had a mean age of 54.7 years, with 78.88% prevalence in males and 66.92% hypertension rate. Type A AD accounted for 40% of all AD cases, and 10.70% of patients with type A AD died in the ED. Elevated BUN levels may be a risk predictor for death in patients with type A AD. [West J Emerg Med. 2022;23(4)473–480.]

INTRODUCTION

Until recently, the exact epidemiology of aortic dissection (AD) was not determined, and it was reported that the estimated incidence of AD was six per 100,000 persons per year in the United Kingdom.[1] The International Registry of Acute Aortic Dissection (IRAD), which was founded in 1996, provides data on large groups of patients with acute AD in the Western population. Several factors, including age, gender, height, weight, and blood pressure, are considered risk factors for AD. The main risk factor for AD is hypertension, which

is observed in 65-75% of AD cases, especially in those with poorly controlled blood pressure.[2] Other risk factors for AD include atherosclerosis (27%); known aortic aneurysm (16%); previous cardiac surgery (16%); Marfan syndrome (5%); iatrogenic causes (4%); and cocaine use (1.8%).[3] In the IRAD series, 67% of patients presented with type A AD and the remaining 33% with type B. Two-thirds of the patients were men, with a mean age of 63 years.[3] However, a higher in-hospital mortality was noted among women than among men.[4]

The objectives of the present study were as follows: 1) to determine the clinical characteristics of Chinese patients with type A and B AD and to evaluate whether there were differences with the Western population and 2) to determine possible differences between the mortality of patients with type A and B AD in the emergency department (ED) and to identify high-risk markers for patients with type A AD.

Population Health Research Capsule

What do we already know about this issue?
Aortic dissection (AD) has become common in the ED, with several studies showing the clinical characteristics of AD in South China.

What was the research question?
What are the differences in clinical characteristics between Chinese and Western patients with AD, and what is the risk predictor for death?

What was the major finding of the study?
In south China, AD patients were younger than the Western population. Elevated blood urea nitrogen may be a risk predictor for death in type A AD.

How does this improve population health?
Further research should be conducted on whether there is a pathogenic gene for aortic dissection in Chinese populations.

METHODS

Study Population

The study protocols were approved by the ethics committee (No. 202012199) of Xiangya Hospital of Central South University and comply with the Declaration of Helsinki. We retrospectively analyzed patients who were diagnosed with AD and admitted to the ED of Xiangya Hospital of Central South University from September 1, 20171–August 31, 2020, regardless of the patient's initial presentation. The inclusion criteria met one of the following: 1) diagnosis of AD by aortic full-length computed tomography angiography (CTA); 2) diagnosis of AD by magnetic resonance imaging great vessel scan; and 3) a sharp drop in blood pressure when admitted to the ED requiring rescue or cardiac arrest without completing the full-length aortic CTA. Cardiovascular color ultrasound was able to reveal AD in the patients, and the criterion for ultrasound diagnosis in this study was visualization of the dissection flap with or without hemopericardium. Patients with a prior AD surgical history were excluded if CTA did not reveal a new AD. In this study, we used the Stanford AD classification, which divides AD into type A, which involves the ascending aorta, and type B, which does not involve the ascending aorta. According to the 2014 European Society of Cardiology guidelines[5] on the diagnosis and treatment of aortic diseases, the time course of AD is divided into acute (<14 days), subacute (15–90 days), and chronic (>90 days) phases.

Data Collection

In this study we used standardized methods for data collection.[5] First, two trained abstractors who were blinded to the study hypothesis retrospectively collected information regarding the basic identity number and type of patients with diagnosed AD (the imaging reports by the radiologist provided the A and B classification) from the hospital information system during the study period. The two abstractors were trained by the senior author (AMW) on 10 random charts to perform the standardized chart review process, and inconsistent data were reviewed by AMW who independently extracted a sample of 60 visits (11.2%). We assessed the abstractor interrupter reliability for the identity number, and the AD type in this analysis was 0.994. We used a Python-based software (designed by GQH) to capture the data, including patient age, gender, records of lab values, and death in the ED, and two authors (LPZ and XYM) verified whether the captured data was consistent with the hospital information system.

Therefore, the basic information of all confirmed AD patients, including age, gender, dissection classification, and whether they were dead or alive in the ED were considered to be accurate and complete. However, not every patient had lab tests in the ED because many patients were already diagnosed in other hospitals and later transferred to our hospital for surgery. Thus, some relevant lab values that were previously reported were not repeated in our department. However, other hospitals' data was not registered in our hospital information system, which led to missing lab values. Missing data was not included in the analysis.

We collected data for variables including age, gender, clinical manifestation, past medical history, and data on lab values, which included the following: blood routine tests (white blood cells [WBCs]; red blood cells; hemoglobin [HGB]; platelets [PLT]; neutrophil [NC]; and lymphocytes [LC]); liver function (alanine aminotransferase [ALT] and aspartate aminotransferase [AST]); kidney function (serum

creatinine [Cr]; blood urea nitrogen [BUN] and uric acid [UA]); coagulation (fibrinogen [FIB]; prothrombin time [PT]; activated partial prothrombin time [APTT]; thrombin time [TT]; international normalized ratio [INR]; fibrinogen degradation products [FDP] and D-dimer); myocardial enzymology (creatine kinase [CK]; creatine kinase isoenzyme [CK-Mb]; lactate dehydrogenase [LDH] and myoglobin [Mb]); total bilirubin (TBIL); triglycerides (TG); total cholesterol (TC); high-density lipoprotein (HDL); low-density lipoprotein (LDH); and C-reactive protein (CRP). All lab work was performed within the first hour after the patient was admitted to the ED. We also collected the mortality and survival data of patients diagnosed with AD in the ED. Data was collected from 1) patients who died in the ED, 2) patients who did not die in the ED and were transferred to the cardiovascular or vascular surgery ward, and 3) patients who did not die in the ED but were discharged upon the patient's or their guardian's request. For this study we did not collect data on whether the patient survived after surgery or discharge.

Statistical Analysis

We performed all statistical analyses using GraphPad Prism 9 (GraphPad Software, Inc, San Diego, CA). The results are expressed as mean ± standard deviation (SD). Continuous variables were compared using Student's t-test for normal distributions and the Mann-Whitney U test for non-normal distributions. Comparisons of rates between groups were performed using the chi-square test or Fisher's exact test. We performed multivariate logistic regression analyses to identify the independent factors related to the deceased group. The threshold for the entry of variables into the multivariate models was P <0.0001. We also calculated odds ratios (OR) and 95% confidence intervals (CI). Statistical significance was set at P <0.05.

RESULTS

We included a total of 535 (422 [78.88%] male, 113 [21.12%] female) AD patients in the study, with a mean age of 54.7±14.1 years (range: 10-92 years), as shown in Table 1. The incidence of type A AD was 40%, while that of type B AD was 60%. We compared our data with those reported in previous studies in the IRAD.[7] The AD patients in our study were younger than the Western population (P <0.0001). Furthermore, our study indicated that male patients had higher values of total AD than those in the Western population (P <0.0001). The classification of AD in our study population is significantly different from that in a study on a Western population by Pape et al.[7] (P <0.0001)

Our study showed that hypertension was the most common risk factor associated with AD, with 137 (64.02%) Type A AD patients with hypertension and 221 (68.85%) Type B AD patients with hypertension (Table 2). The difference between the rates of hypertension in type A and type B AD was not significant (P >0.05). Patient history is shown in Table 3.

Table 4 lists the clinical symptoms of patients with AD. More than 30 different symptoms at onset and during progression were observed. Patients with type A AD had a higher rate of chest pain than those with type B AD (P <0.0001), while abdominal pain was more common in patients with type B AD than in patients with type A AD (P <0.0001). Other chest symptoms, including chest tightness and shortness of breath, were more common in patients with type A AD than in those with type B AD (P <0.0001, P

Table 1. Gender, classification and age differences between South China and Western populations (IRAD* data).

	South China data (N = 535)	IRAD data[7] (N = 4,428)	*P* value
Gender			
Male	422	2,964	<0.0001
Female	113	1,464	
Classification			
Type A AD	214	2,952	<0.0001
Type B AD	321	1,476	
Age			
Total AD	54.7±14.1	62.2 ±14.5	All *P* <0.0001
Type A AD	54.7±13.7 (n = 214)	61.5±14.6 (n = 2,952)[7]	
Type B AD	58.0±14.2 (n = 321)	63.6±14.1 (n = 1,476)[7]	

IRAD, International Registry of Aortic Dissection; *AD,* aortic dissection.

Table 2. Differences in total hypertension rate in aortic dissection patients.

	South China population	Western population[7]	Total	P value
Hypertension in AD	358	3,247	3,605	<0.01
Non-hypertension in AD	177	1,181	1,358	
Hypertension in Type A AD	137	2,089	2,226	<0.0001
Non-hypertension in Type A AD	77	2,952	3,029	
Hypertension in Type B AD	221	1,158	1,379	<0.001
Non-hypertension in Type B AD	100	318	418	

AD, aortic dissection.

Table 3. Patients' istories.

	Type A AD	Type B AD	P value
Patients	214	321	
Age	54.7±13.7	58.0±14.2	<0.01
Gender (male,%)	157,73.36%	265,82.55%	<0.01
Connective tissue disease	1	1	1.00
Drinking	12	18	1.00
History of AD surgery	6	9	1.00
Familial AD	1	2	1.00
Pregnancy	2	2	1.00
Previous cerebral infarction	5	6	0.76
COPD	2	5	0.71
Smoking	47	65	0.67
History of AD without surgery	1	4	0.65
Atrial fibrillation	2	1	0.57
Bradycardia	2	1	0.57
CKD5	6	13	0.49
Scoliosis	1	0	0.40
Marfan syndrome	3	1	0.31
Diabetes	8	7	0.30
Hypertension (%)	137 (64.02%)	221 (68.85%)	0.26
Coronary athero-sclerotic heart disease	18	39	0.20
History of heart surgery	4	1	0.09
Died in ED	23, 10.75%	6, 1.87%	<0.0001

AD, aortic dissection; COPD, chronic obstructive pulmonary disease; *CKD,* chronic kidney disease; *ED,* emergency department.

Table 4. Signs and symptoms in aortic dissection patients.

Clinical symptoms	TAAD (N = 214)	TBAD (N = 321)	P value
Chest pain	109	93	<0.0001
Back pain	14	26	0.62
Chest and back pain	30	53	0.47
Abdominal pain	19	86	<0.0001
Chest tightness	25	7	<0.0001
Dizziness and headache	6	8	1.00
Cough	2	2	1.00
Hoarseness	0	1	1.00
Unclear speech	0	1	1.00
Shock	0	1	1.00
Hemoptysis	1	3	0.65
Hematemesis	0	2	0.52
Hematuria	0	2	0.52
Obstipation	0	2	0.52
Painful urination	0	2	0.52
Cardiac arrest	1	0	0.40
Twitch	1	0	0.40
Asymptomatic	3	10	0.26
Vomiting	4	2	0.22
Limb weakness or pain	10	8	0.22
Abdominal fullness	0	5	0.16
Coma	2	0	0.16
Neck pain	2	0	0.16
Fever	2	0	0.16
Bloody stools	1	7	0.15
Syncope	7	3	0.10
Palpitations	4	1	0.09
Onset as new cerebral infarction	4	1	0.09
Waist pain	0	6	0.09
Weariness	0	6	0.09
Post-trauma	0	6	0.09
Shortness of breath	10	3	<0.01
Confusion	12	4	<0.01
Onset as acute myocardial infarction	6	1	0.02

TAAD, type A aortic dissection; *TBAD,* type B aortic dissection.

<0.05, respectively). Central nervous system symptoms were higher in the type A AD group than in the type B AD group (P <0.05). Furthermore, the onset of acute myocardial infarction appeared to be an initial presentation that was higher in type A than in type B AD (P <0.05).

Among a total of 535 patients, 511 had a recorded duration of symptom onset when admitted to our ED. Of the 201 patients with a recorded duration among 214 patients with type A AD, 194 were from the acute AD group, four were from the subacute AD group, and three were from the chronic AD group. There were 310 patients with a recorded duration time among 321 type B AD patients, with 280 from the acute AD group, 22 from the subacute AD group, and eight from the chronic AD group. The chi-square test indicated that patients with type A AD had a higher proportion of acute AD clinical manifestations than those with type B AD (P <0.05).

Subsequently, we analyzed the mortality rate of 214 patients with type A AD in the ED. Sixteen male (aged 53.6±12.7 years) and seven female (aged 57.6±15.7 years) patients died in the ED. There were no age- or gender-related differences in the mortality rates of patients with type A AD (P >0.05, respectively). Of the 321 type B AD patients, there

were five males and one female who died in the ED. The mortality rate in type A AD patients was higher than that in type B AD patients in the ED (P <0.0001). Among the 23 patients with type A AD who died, 18 died within 24 hours (h) of symptom onset, two died within 48 h of symptom onset, one died within 72 h of symptom onset, and one died 10 days from symptom onset. One patient did not have a record of the duration from symptom onset to admission in the ED, but the patient died 4 h after admission to the ED.

Due to the higher mortality rate of Type A AD, we analyzed the data of the deceased and survivor patients (Table 5). Of the 191 patients in the surviving group 161 had complete data, while 15 of the 23 patients in the deceased group had complete data. The 23 patients in the deceased group, with a mean age of 60.1±12.8 years, were older than the 191 survivors, who had a mean age of 54.0±13.7 years (P <0.05). The values of WBC, NC, HDL, APTT, and D-dimer were all higher in the deceased group than in the surviving group, and the HGB levels were lower in the deceased group than in the surviving group. As a reflection of organ function, BUN, Cr, UA, ALT, AST, CK, CK-MB, LDH, and Mb were all higher in the deceased group than in the surviving group.

We performed multivariate logistic regression analyses to determine independent factors related to the deceased patient group. The threshold for the entry of variables into multivariate models was P <0.0001. The results of the multivariate logistic regression analysis are shown in Table 6. We found that BUN levels (P<0.01; OR, 0.8408) were significantly associated with death.

Table 5. The differences between surviving and deceased patients in Type A AD.

	Survivor	Deceased	P value
Age	54.0±13.7	60.1±12.8	0.04
WBC	11.78±0.37	14.35±1.23	0.04
HGB	126.2±1.78	111.9±8.7	0.02
PLT	181.1±6.30	175.9±20.67	0.08
NC	9.71±0.36	12.51±1.14	0.02
LC	1.13±0.53	0.94±0.09	0.28
BS	7.61±0.16	8.77±1.50	0.11
BUN	7.52±0.34	13.23±1.45	<0.0001
Cr	124.1±9.97	247.9±42.95	<0.001
UA	384.5±11.74	540.9±55.31	<0.001
TBIL	17.80±0.93	20.90±3.57	0.35
TC	4.36±0.92	4.25±0.25	0.71
TG	1.79±0.16	1.65±0.20	0.79
HDL	1.09±0.28	1.77±0.70	0.01
LDL	2.69±0.56	2.48±0.23	0.30
CK	214.1±40.26	549.1±278.4	0.03
LDH	289±29.77	2278±1517	<0.0001
CKMB	19.35±1.98	112.6±66.05	<0.0001
Mb	155.8±40.39	905.4±442.5	<0.0001
ALT	64.29±17.76	643.5±482	<0.01
AST	85.65±27.03	743.5±439.2	<0.0001
CRP	37.63±4.44	28.11±14.94	0.61
PT	15.65±0.71	18.92±2.59	0.21
APTT	34.77±1.13	49.85±11.26	<0.01
TT	202.7±1.46	23.66±3.72	0.52
FIB	3.37±0.17	2.94±0.49	0.47
INR	1.26±0.64	1.53±.024	0.23
FDP	27.53±2.41	43.56±10.09	0.07
D-dimer	2.17±0.17	4.16±0.87	<0.01

WBC, white blood count; *HGB,* hemoglobin; *PLT,* platelet count; *NC,* neutrophil count; *LC,* lymphocyte count; *BS,* blood sugar; *BUN,* blood urea nitrogen; *Cr,* creatine levels; *UA,* urinalysis; *TBIL,* total bilirubin; *TC,* total cholesterol; *TG,* triglycerides; *HDL,* high-density lipoprotein; *LDL,* low-density lipoprotein; *CK,* creatine kinase; *LDH,* lactate dehydrogenase; *CKMB,* creatine kinase-MB; *Mb,* myoglobin; *ALT,* alanine aminotransferase; *AST,* aspartate aminotransferase; *CRP,* C-reactive protein; *PT,* prothrombin time; *APTT,* activated partial thromboplastin time; *TT,* thrombin time; *FIB,* fibrinogen; *INR,* international normalized ratio; *FDP,* fibrin degradation products.

DISCUSSION

Aortic dissection is a life-threatening vascular disease associated with high morbidity, and most patients with AD are diagnosed in the ED. In our study, 29 (5.42% of all patients with AD) died in the ED. There was a relatively low mortality rate of 10.70% among patients with type A AD who died in the ED. Among the 23 deceased type A AD patients, 18 (78%) died within the first 24 h, while the others died during the acute course. In Japan, the prehospital mortality rate is 61.4%. Combining prehospital with in-hospital mortality rates shows that 93% of deaths from AD occur within 24 h after onset.[8] A previous study showed that 22.7% of the hospitalized patients died within the first 6 h, 33.3% within 12 h, 50% within 24 h, and 68.2% within the first two days after admission.[8] The reason for the relatively low mortality in our ED may have been because many dissection patients died at home or on the way to the hospital. Moreover, in our study, the average age of patients with AD was lower than that among Western patients. Japanese AD patients exhibited a peak in AD at 70 years of age,[8] with younger patients having relatively healthier bodies and fewer comorbidities.

Emergency physicians are familiar with the diagnosis and treatment of AD, and patients with chest and abdominal symptoms as the first manifestation rarely underwent only radiographic examinations; they almost always had CT performed. Especially for patients with unexplained chest and abdominal pain, AD could be diagnosed quickly. In the ED, AD patients received active blood pressure and heart rate control,[10,11] and cardiovascular and vascular surgeries were quickly informed, which reduced the time to surgery and hospital admission, all of which led to decreased mortality

Table 6. Multivariate logistic regression models for independent factors related to patient deaths.

	P	OR	95% CI
BUN	<0.01	0.8408	0.7459 - 0.9441
LDH	0.25	0.9988	0.9949- 1.000
CKMB	0.07	0.9841	0.9644 -1.001
Mb	0.23	1.001	0.9997 - 1.002
AST	0.33	1.002	0.9997 - 1.008

OR, odds ratio; *CI,* confidence interval; *BUN,* blood urea nitrogen; *LDH,* lactate dehydrogenase; *CKMB,* creatine kinase-MB; *AST,* aspartate aminotransferase.

in AD patients. Deceased patients with type A AD had the following characteristics: older age; higher WBC, NC, HDL, APTT, and D-dimer levels; lower HGB; and remarkable organ dysfunction, including impairments to renal function (BUN and Cr), liver function (ALT and AST), and myocardium (CK, CK-MB, LDH, and Mb), while the BUN level appeared to be a predictor of death.

A previous study in China demonstrated that the WBC count is a potential independent risk factor for in-hospital death in type A AD patients.[12] Another study also indicated that increased Cr, BUN, and AST levels were significantly related to a higher rate of in-hospital mortality in patients with type A AD.[13] The WBC and NC elevation might be a result of the effects of a systemic inflammatory response syndrome in AD pathology.[8] Type A AD could affect the ascending aorta and even extend to the full length of the aorta, leading to organ dysfunction in any involved vascular area of the body, which might be the reason for organ dysfunction.[7]

With increased economic development and improvements in living standards, both hypertension and atherosclerosis are becoming more common in the Chinese population. This has led to an increase in the number of AD patients, and with improvements in physicians' awareness of AD and the high availability of CT, the diagnosis rate of AD has also been increasing.[14] However, our results indicated that AD in South China showed differences with AD in Western populations. In South China, the number of type B AD patients was higher than that of type A AD patients, while in Western populations the number of type B AD patients was lower than that of type A AD patients. Furthermore, in our study, Chinese AD patients presented their initial symptoms at an average age of 54 years, which is lower than that of Western populations by roughly 10 years and lower than that of Japanese AD patients by approximately 15 years.[8]

Our results were in line with those of another Chinese study[14] that included 1003 AD patients with a mean age of 52 years and that had a higher number of type B AD patients than type A AD patients. The previous study,[14] the first Registry of Aortic Dissection in China (Sino-RAD), showed that the Chinese population was different from European and American populations in terms of age of onset, gender, clinical manifestations, and fatality rate. However, there have been no new AD data reports in the past seven years, although Sino-RAD has described a number of pathogenic characteristics of the Chinese people.[15] Nevertheless, the reason for the difference between the Chinese and Western populations is still unclear. We speculate that this difference might be associated with China's large geographic area and uneven economic development. Many hypertensive patients are not detected at an early stage and are actively treated and well controlled,[16] while uncontrolled hypertension remains the most significant treatable risk factor for acute AD.[1] Additionally, racial differences should also be considered; for example, Black patients were younger with a higher prevalence of type B AD (52.4%) than those in White patients.[17] Furthermore, in China every county hospital was equipped with CT, and almost all patients underwent CT examination when the patient had an unexplained chest pain or abdominal pain. These CT tests might have increased the detection rate of AD.

Our study showed that hypertension was most common in patients with AD. However, the results indicated that the hypertension rate in patients with AD in South China was lower than that in Western populations, with a hypertension rate of 76.6% as the most common risk factor. Smoking, drinking, and coronary atherosclerotic heart disease were also common in both type A and type B AD patients. These results are in line with a previous Chinese investigation that showed that smoking and drinking were the common risk factors for Chinese AD patients.[14] However, other risk factors such as Marfan syndrome, connective tissue disease, diabetes, and history of AD surgery for heart surgery were not common in the South China AD patients, while previous cardiac surgery, Marfan syndrome, and cocaine use have been implicated in Western patients.[3] The reasons for the differences in these risk factors between the Chinese and Western populations may be related to differences in eating habits and body mass index, which may have led to a lower incidence of hypertension in the Chinese population than in the Western population.[18,19] Moreover, racial differences and the relatively small sample sizes should also be considered.

In our study we discerned more than 30 different symptoms at onset and during progression; therefore, it was not easy to diagnose AD immediately based only on the symptoms. The most common symptom was pain: type A AD patients had a higher degree of chest pain and other chest symptoms, including chest tightness and shortness of breath, while abdominal pain was more common in patients with type B AD. Central nervous system symptoms and onset of acute myocardial infarction were also more common in type B AD. The differences in symptoms between type A and type B AD are related to the location of the dissection tear. Because type A AD can involve the full length of the aorta, it leads to more diverse clinical manifestations in patients with type A AD.[5,7,20]

LIMITATIONS

First, we retrospectively analyzed the data of only our ED patients; date of patients admitted through outpatient procedures were not collected because patients in our hospital came from the Hunan province and neighboring 2–3 provinces. Thus, the epidemiology of AD could not be accurately estimated. Second, we had no follow-up data on signed and discharged patients and hospitalized patients, and the mortality rate of AD might, therefore, be lower than the actual rate. Third, this study did not explore the effects of drugs on mortality and laboratory test results. Some patients received drug treatment before admission. For example, patients with previous coronary atherosclerotic heart disease may have had oral aspirin, clopidogrel, or ticagrelor, and patients who had undergone heart surgery in the past may have been taking oral warfarin, and these drugs might have affected the lab values. Our results indicated that the ages at which the incidence of AD and the hypertension rate peaked were lower than those in Western countries; however, the possible reasons for this observation were not determined, and further research should focus on exploring whether the differences between the genetic characteristics and living habits of Chinese and Western people cause differences in AD characteristics.

CONCLUSION

In South China, AD patients had a mean age of 54.7 years, 78.88% of whom were male and had a hypertension rate of 66.92%. Type A AD patients constituted 40% of all AD patients, and 10.70% of type A AD patients died in the ED. Elevated blood urea nitrogen levels might be a risk predictor for death in patients with type A AD.

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Poison Ivy Dermatitis Treatment Patterns and Utilization: A Retrospective Claims-based Analysis

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Introduction: Poison ivy (toxicodendron) dermatitis (TD) resulting from contact with poison ivy, oak, or sumac is a common form of allergic contact dermatitis that impacts millions of people in the United State every year and results in an estimated 43,000 emergency department (ED) visits annually. Our objective in this study was to evaluate whether healthcare utilization outcomes are impacted by prescription practices of systemic corticosteroids.

Methods: We used a health claims database from 2017-2018 of those treated for TD. Descriptive statistics and logistics regression models were used to characterize trends.

Results: We included in this analysis 115,885 claims from 108,111 unique individuals (93.29%) with 7,774 (6.71%) return claims within 28 days. Of the return claims, 470 (6.05%) were to the ED. Emergency clinicians offered no oral corticosteroid prescription 5.27% (n = 3,194) of the time; 3276 (86.26%) prescriptions were for a duration of 1-13 days, 410 (10.80%) were for 14-20 days, and 112 (2.95%) were for >21 days. Further, we found that shorter duration oral corticosteroids (odds ratio [OR] 1.30; 95% confidence interval 1.17-1.44; P <0.001) and initial treatment for TD at the ED compared to primary care clinicians (OR 0.87 [0.80, 0.96]; P <0.001) and other non-dermatologists (OR 0.89 [0.80, 0.98]; P = 0.01) places patients at an increased risk for return visits with healthcare clinicians when controlling for drug group, duration of treatment, and initial treatment location.

Conclusion: Despite recommendations to treat TD with oral steroids for at least 14 days, most emergency clinicians offered this treatment for shorter durations and was associated with return visits. Emergency clinicians should consider treatment of two to three weeks when providing systemic steroid coverage when there are no limiting contraindications, especially as patients who present to the ED may do so with more severe disease. Additional education may be needed on appropriate treatment pathways for TD to reduce healthcare utilization associated with undertreatment. [West J Emerg Med. 2022;23(4)481–488.]

INTRODUCTION

Poison ivy (toxicodendron) dermatitis (TD) results from contact with poison ivy, oak, or sumac and is a common form of allergic contact dermatitis (ACD) that affects millions of people in the United States every year,[1] and it accounts for an estimated 43,000 annual visits to the emergency department (ED). Due to seasonal effects, a number of states see an increase in the number of cases during the summer months, likely due to increases in the growth of the plants containing urushiol, the allergen causing TD, as well as the increase in the number of individuals participating in outdoor activities.[2] While

some cases of TD remain mild and can be managed at home with little to no medical intervention, other cases can elicit more severe reactions. Toxicodendron dermatitis can cause discomfort and marked itching, as well as the formation of blisters. Depending on the location of these eruptions, patients can also suffer from limitations in activities of daily living, such as sitting, walking, or mental concentration due to these symptoms.

Like other forms of ACD, the treatment of TD relies on the use of topical and/or systemic corticosteroids to suppress the immune response to urushiol. However, the strength and ideal duration of such pharmaceutical interventions is not well established in the literature. It has been demonstrated that treatment plans that are too short are less likely to be effective in controlling the symptoms. In particular, the effectiveness of short-course, prepackaged oral corticosteroids is of questionable use. Ives and Tepper reported a number of severe cases treated with prepackaged methylprednisolone in which the patients did not achieve effective control of their symptoms.[3] Further, several papers have also cautioned against the use of prepackaged oral corticosteroids that provide a short duration of treatment, due to the risk of rebound dermatitis after shorter therapeutic interventions.[4,5]

Despite these recommendations, a recent study of healthcare claims revealed that there are variable uses of corticosteroids both in terms of potency and route of administration (eg, topical vs oral).[2] The cost of these treatments varied depending on healthcare setting (eg, outpatient vs emergency) and type of treatment.[2] The majority of these claims took place in a primary care setting, with 6% being seen in the ED or by emergency clinicians.[2]

Due to the variability in the treatments and healthcare setting, we hypothesized that this variability could result in the prescription of subtherapeutic therapies for patients presenting with TD, resulting in poorer health utilization outcomes, including increased risk of return visits. Thus, our objective in this study was to identify frequency patterns of various oral corticosteroid prescription durations and evaluate the impact of prescription duration on health utilization outcomes, particularly in terms of return visits within 30 days to the ED.

Population Health Research Capsule

What do we already know about this issue?
Toxicodendron dermatitis (TD) is a common, seasonal dermatologic condition that affects millions of people in the United States annually.

What was the research question?
How does type and duration of treatment for TD impact odds of return healthcare visits within 28 days?

What was the major finding of the study?
Shorter duration (<14 days) of treatment is associated with 1.30 increased odds of a return healthcare visit.

How does this improve population health?
Providing adequate oral corticosteroid coverage can reduce healthcare utilization and cost of care for the treatment of TD.

METHODS

This study included a retrospective analysis of healthcare claims from the IBM MarketScan Research Databases (IBM Corporation, Armonk, NY). These databases contain de-identified healthcare claims from 2017-2018 for approximately 27 million privately insured individuals residing in the US. Those with Medicare or Medicaid are not included in this data and thus the sample is restricted to only those <65 years of age. Specific data abstracted for this analysis included basic demographic information along with details regarding the date, clinician type, and purpose of the visit for outpatient healthcare encounters. These databases also include details on prescription claims including the date of the claim, National Drug Code (NDC) numbers, refill counts, and days' supply.

We included only adult patients who had at least one outpatient claim for TD during the study period. No sample size calculation was conducted a priori as all eligible claims were included in the analysis. Outpatient healthcare encounter claims were identified by the *International Classifications of Disease 10th Revision* (ICD-10) codes for ACD due to contact with plants (except food [L23.7]), which is largely due to TD. As patients can accrue multiple claims per day and contract TD multiple times per year, only one claim per day was included per patient and restricted to the first annual encounter. We also removed duplicate patient encounters in 2018 from the analysis to elininate the potential impact of patient-specific variation. A flow diagram of participant selection and inclusion is provided in Figure 1. Prescription treatments were restricted to oral systemic corticosteroids. In the study period we also evaluated follow-up treatment for 28 days after the first claim, and we identified return visits as those where the ICD-10 code for ACD due to plants was also used.

Claims were identified by place of service and divided into five categories based on current procedural terminology codes and MarketScan place of service identifiers: ED; urgent care (UC); dermatology; primary care physicians (PCP) including family and internal medicine clinicians;

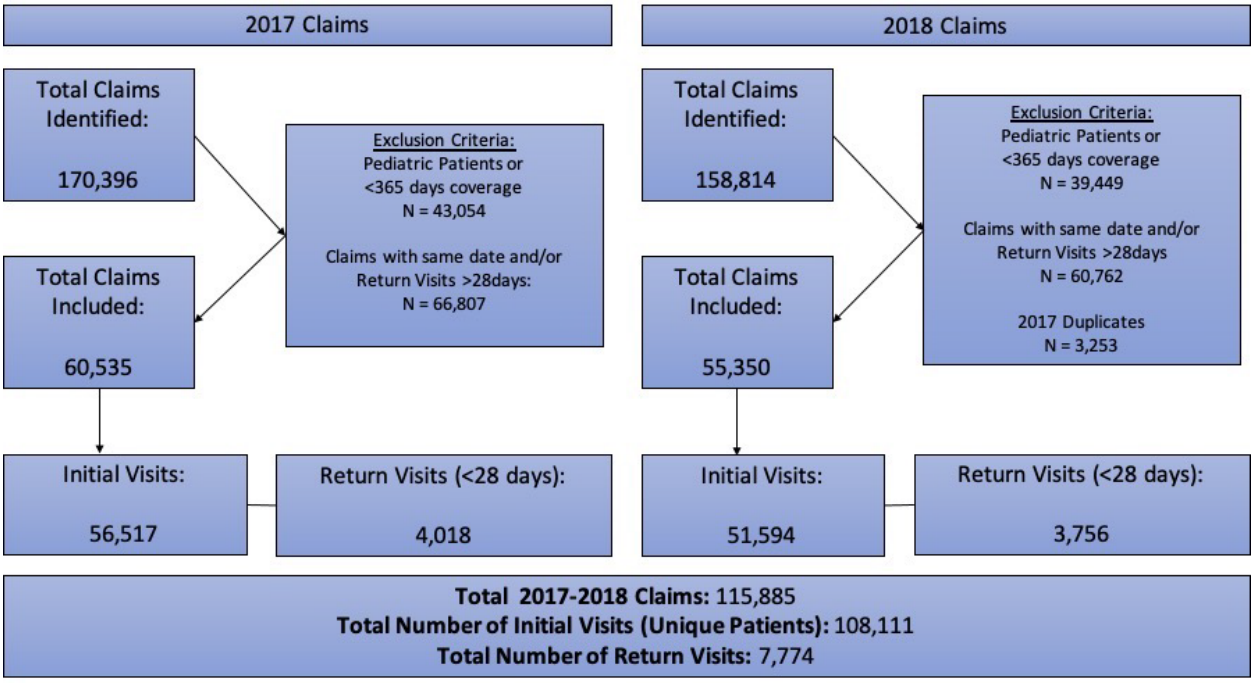

Figure 1. Flow diagram of claim selection and inclusion for patients treated for toxicodendron dermatitis in the United States.

and other non-dermatology clinicians (such as non-specified nursing visits, geriatric medicine, allergy and immunology, etc). Oral corticosteroids were identified using NDC numbers and included dexamethasone, methylprednisolone, prednisolone and prednisone. Duration of treatment was also broken into four groups: no oral corticosteroid treatment; 1-13 days of treatment; 14-20 days; and 21 days or more based on the days' supply.

Statistical Analysis

Descriptive summary statistics were used to characterize overall trends in the data. We built univariable logistic regression models for dichotomous outcome variables predicting a return visit within 28 days and a return visit to the ED within the same time frame. Predictor variables included drug type, duration of treatment, and initial treatment location. Odds ratios (OR) were calculated with 95% confidence intervals (CI). We created an additional multivariable model using drug group, days' supply, and initial location as predictors for a return healthcare visit. Due to limited occurrences, we excluded prednisolone and dexamethasone in these regression analyses.

To validate the data extraction methods and final univariable and multivariable models, we first conducted the analysis on the 2017 data and re-ran it using the 2018 data as an independent sample. Once the data extraction methods and models were verified and consistent across both years, the data were merged, and the final models were applied to the combined years of data after removing duplicates. Goodness-of-fit for logistic regression models was evaluated using the Hosmer-Lemeshow goodness-of-fit test via the LACKFIT option in SAS. Large values for the chi-square for Hosmer-Lemeshow (χ^2_{HL}) and small *P*-values (<0.05) were indicative of poor model fit. All final models used in this analysis failed to meet this criterion for poor fit and were therefore accepted as valid models. We conducted all statistical analyses using SAS version 9.4 (SAS Institute Inc, Cary, NC). This study was approved by the Penn State University Human Subjects Protection Program Institutional Review Board.

RESULTS

General Characteristics of Claims

During the study period, a total of 115,885 claims were identified and included in this analysis with 108,111 (93.29%) unique individuals who were seen for TD (characteristics of the claims are presented in Table 1). Nearly half of these patients were male (n = 56,002; 51.80%) with an average age of 44.19 years (standard deviation 13.17). The ED and UC visits made up 16.32% (n = 17,645) of the total initial visits, while PCPs made up the majority of clinicians for the initial visit with a total of 47,719 (44.14%). Non-dermatology clinicians contributed to 30.55% (n = 33,033) of initial visits while dermatologists made up 8.99% (n = 9,714). Within 28 days of the initial visit, an additional 7,774 (6.71%) patients incurred at least one return visit. Of these return visits, 470 (6.05%) were to an emergency clinician.

Prescription Trends

Trends in oral corticosteroid prescriptions and treatments at the initial visit are presented in Table 2. In terms of

Table 1. Characteristics of claims 2017-2018 for toxicodendron dermatitis-related treatment.

Total number of eligible claims	115,885
Total unique adult patients	108,111 (93.29%)
Male	56,002 (51.80%)
Female	52,109 (48.20%)
Age (mean [SD]); [range]	44.19 (13.17); [18, 64]
Treatment locations first visit	
Emergency department	7,091 (6.56%)
Urgent care	10,554 (9.76%)
Dermatology	9,714 (8.99%)
Primary care*	47,719 (44.14%)
Other non-dermatology	33,033 (30.55%)
Total number of return claims (<28 days)	7,774 (6.71%)
Emergency department	470 (6.05%)
Urgent care	513 (6.60%)
Other	6,791 (87.36%)

*Primary care physicians include family and internal medicine clinicians.
SD, standard deviation.

treatment options, more than half of patients (56.09%; n = 60,637) received no oral corticosteroid as treatment for their TD and 42.94% were prescribed at the initial visit (n = 46,425). Of those with an oral corticosteroid prescription prescribed at the initial visit, 81.14% were for a supply of 1-13 days (n = 37,521), 16.59% were for a supply of 14-20 days (n = 7,672), and 2.27% were for a supply of ≥21 days (n = 1,052). In terms of prescription duration and specialty, clinicians in the ED offered no oral corticosteroid prescription 5.27% (n = 3,194) of the time, and 86.26% prescriptions were for a duration of 1-13 days (n = 3,276). Prednisone made up the majority of first prescriptions (83.98%; n = 38,990), followed by methylprednisolone (15.25%; n = 7,078). Additionally, most methylprednisolone prescriptions (99.52%; n = 7,044) were for a duration of 1-13 days while only 77.75% (n = 30,315) of the prednisone prescriptions were for 1-13 days.

Impact of Treatment on Healthcare Utilization

Table 3 shows factors associated with an increase in healthcare utilization. In terms of return visits within 28 days, receiving no prescription resulted in a lower likelihood of having a return visit both in terms of drug group and duration (OR 0.68 [0.65, 0.72] and OR 0.84 [0.76, 0.93], respectively). Those who received methylprednisolone had increased odds of a return visit when compared to those who received prednisone (OR 1.13 [1.02, 1.24]). Similarly, those who received a prescription for 1-13 days' supply had increased odds of a return visit when compared to those who received a script for 14-20 days (OR 1.32 [1.19, 1.46]). Lastly, those first seen in the ED were also more likely to experience return visits as well as return visits to the ED when compared to all other specialists.

When we included and controlled for all variables, drug group, duration of treatment, and initial treatment location remained statistically significant predictors of a return healthcare visit (Table 4). Most notably, duration of treatment 1-13 days retained a significantly higher likelihood (OR 1.30 [1.17,1.44]) of a return healthcare visit compared to

Table 2. Frequency of oral corticosteroid prescriptions and duration of treatment at first visit 2017-2018.

	No prescription	1-13 Days	14-20 days	21+ days	Totals
Drug type					
No oral corticosteroid	60,637 (56.09)	-	-	-	60,637 (56.09)
Methylprednisolone	-	7,044 (99.52)	10 (0.14)	24 (0.34)	7,078 (6.62)
Prednisolone	-	10 (83.33)	2 (16.67)	0 (0.00)	12 (0.01)
Prednisone	-	30,315 (77.75)	7,650 (19.62)	1,025 (2.63)	38,990 (36.48)
Dexamethasone	-	152 (92.12)	10 (6.06)	3 (1.82)	165 (0.15)
Site/Specialty of first care					
Emergency department	3,194 (5.27)^	3,276 (86.26)	410 (10.80)	112 (2.95)	3,798 (8.21)*
Urgent care	4,714 (7.77)^	4,878 (85.37)	734 (12.85)	102 (1.79)	5,714 (12.36)*
Dermatology	7,847 (12.94)^	1,119 (61.99)	558 (30.91)	128 (7.09)	1,805 (3.90)*
Primary care	26,922 (44.40)^	17,534 (86.60)	2,325 (11.48)	387 (1.91)	20,246 (43.78)*
Other non-dermatologist	17,960 (29.62)^	10,714 (72.97)	3,645 (24.83)	323 (2.20)	14,682 (31.75)*
Total	60,637^	37,521 (81.14)	7,672 (16.59)	1,052 (2.27)	46,245 (100.00)*

^Percentages for no prescription are based on the total number of visits in which patients received no oral corticosteroid prescription at the first visit.
*Totals are excluding no prescription counts.

Table 3. Univariable logistic regression: predictors of increased healthcare utilization 2017-2018

Outcome = return visit in 28 Days (n = 7,774)			
Predictor	Odds ratio	95% Wald confidence limits	P-value
Drug group (P <0.0001)			
No prescription vs prednisone	0.68	[0.65, 0.72]	<0.0001
Methylprednisolone vs prednisone	1.13	[1.02, 1.24]	0.01
Duration (P <0.0001)			
No prescription vs 14-20 days	0.84	[0.76, 0.93]	<0.001
1-13 days vs 14-20 days	1.32	[1.19, 1.46]	<0.0001
21+ days vs 14-20 days	1.20	[0.93, 1.55]	0.16
Initial treatment location (P <0.0001)			
Urgent care vs ED	0.83	[0.74, 0.93]	<0.001
Dermatologist vs ED	0.73	[0.65, 0.81]	<0.001
Primary care vs ED	0.77	[0.71, 0.85]	<0.001
Other non-dermatologist vs ED	0.78	[0.71, 0.86]	<0.001
Outcome = Return Visit to the Emergency Department (n = 470)			
Predictor	Odds ratio	95% Wald Confidence Limits	P-value
Drug group (P <0.0001)			
No prescription vs prednisone	0.65	[0.53, 0.80]	<0.001
Methylprednisolone vs prednisone	0.58	[0.40, 0.85]	0.005
Duration (P = 0.04)			
No prescription vs 14-20 days	0.69	[0.46, 1.02]	0.06
1-13 days vs 14-20 days	0.88	[0.60, 1.30]	0.51
21+ days vs 14-20 days	1.38	[0.59, 3.25]	0.46
Initial treatment location (P <0.0001)			
Urgent care vs ED	0.10	[0.07, 0.14]	<0.001
Dermatologist vs ED	0.03	[0.02, 0.06]	<0.001
Primary care vs ED	0.09	[0.07, 0.11]	<0.001
Other non-dermatologist vs ED	0.08	[0.06, 0.10]	<0.001

ED, emergency department.

those treated for 14-20 days, after controlling for drug type and initial treatment location. Interestingly, we found no significant difference in the likelihood of a return healthcare visit for those initially seen in the ED when compared to those seen by dermatologists in the multivariable model.

DISCUSSION

This study revealed that oral corticosteroids were prescribed to treat TD at the initial visit for less than half of visits. Most prescriptions were for durations of less than two weeks, which is shorter than the recommended treatment duration reported in the literature.[6] As the immunologic response to urushiol can take up to 14 days to present in sensitized patients with exposure, TD reactions have the potential to continue to manifest or worsen throughout that 14-day period.[1,7] Thus, shorter courses of oral corticosteroids pose the risk of patients experiencing rebound dermatitis,[1,4] where signs and symptoms of an acute dermatitis can recur or flare after temporary suppression with an immunosuppressive medication, such as oral corticosteroids. This may result in the need for additional healthcare intervention due to its symptomatic nature. As oral corticosteroids are generally reserved and recommended for moderate to severe cases of TD, they should be prescribed for longer courses when medically indicated to prevent the possibility of rebound dermatitis.

Our findings further support and expand on previous clinical trial research. In 2014, Curtis and Lewis conducted a randomized controlled trial comparing a five-day course of prednisone to a 15-day tapered course of prednisone.[8] Those receiving the longer course experienced improvement and resolution of symptoms sooner than those on the shortened course (approaching statistical significance) and used fewer supplementary medications such as prescription oral and

Table 4. Multivariable logistic regression: predictors of increased healthcare utilization 2017-2018.

Outcome = return visit in 28 Days (n = 7,774)			
Predictor	Odds ratio	95% Wald Confidence Limits	P-value
Drug group (P = 0.001)			
No prescription vs prednisone	0.84	[0.76, 0.93]	0.001
Methylprednisolone vs prednisone	1.09	[0.99, 1.19]	0.09
Duration (P <0.0001)			
1-13 days vs 14-20 days	1.30	[1.17, 1.44]	<0.001
21+ days vs 14-20 days	1.17	[0.91, 1.51]	0.22
Initial treatment location (P <0.0001)			
Urgent care vs ED	0.82	[0.73, 0.92]	0.001
Dermatologist vs ED	0.92	[0.81, 1.04]	0.16
Primary care vs ED	0.80	[0.73, 0.88]	<0.001
Other non-dermatologist vs ED	0.81	[0.73, 0.90]	<0.001

ED, emergency department.

topical corticosteroids as well as over-the-counter treatments (eg, calamine lotion, antihistamines, hydrocortisone cream, and other lotions).[8] Additional publications have also supported that a minimum of 14-21 days of oral corticosteroid treatment is necessary when being prescribed for TD,[1,6,9-15] as the hypersensitivity reaction can take up to 14 days to clinically manifest.

This study found that shorter duration oral corticosteroids can be problematic in the treatment of TD both independently and controlling for drug type and treatment location. As the majority of methylprednisolone prescriptions were for shorter duration courses, the use of methylprednisolone also became a significant predictor of return healthcare visits in the univariable analyses. However, when controlling for duration of treatment and initial treatment location, this association pulled closer to the null hypothesis and was no longer statistically significant suggesting that duration of treatment is driving this association. These findings also expand on the conclusions drawn by Curtis and Lewis that shorter duration oral corticosteroids can also result in higher odds of having a return visit, which could increase the cost of care for the patients.

Treatment in an ED was predictive of return visits within 28 days when compared to other clinician groups, except for dermatologists in the multivariable model. These findings of increased healthcare utilization are consistent with several studies showing that repeat utilization of the ED makes up for a large number of ED visits.[16] The lack of difference in healthcare utilization outcomes between dermatologists and ED clinicians after controlling for drug type and duration of treatment could be explained by the severity of the patients seen in these two specialties. As dermatologists are typically not first-line clinicians who treat TD and EDs are generally used for more urgent health concerns, the potential presence of more severe cases in these two practices highlights the need for more clinical guidance regarding the appropriate treatment pathways for TD in an ED setting. These utilization patterns could also be the result of EDs commonly requesting patients to follow up with their PCP for their condition or could reflect more limited training in use of oral corticosteroids for TD and similar conditions; however, emergency clinicians did prescribe similar proportions of oral corticosteroids for 1-13 days as UC clinicians and PCPs. While emergency clinicians offered oral corticosteroids prescriptions for TD, many (86.26%) were for less than two-weeks duration. Less than 3% of emergency clinicians prescribed oral corticosteroids for more than 21 days, a treatment associated with higher efficacy and reduction in return visit rates. High ED utilization for the treatment of TD can also lead to increased healthcare costs as ED costs are higher overall.[16] as well as for TD in particular.[1,2]

The findings also demonstrated that outcomes for those who received no prescription were better in terms of healthcare utilization (eg, return healthcare visits) compared to those who received treatment. This finding stands in contrast to our other findings. However, if those patients receiving no prescription were a patient population with very mild symptoms, it would explain this discrepancy. Since this study involved the analysis of claims data, we were unable to confirm diagnosis or disease severity. The treatment of TD is highly variable based upon the severity of reactions, and duration of treatment could have been based on the severity of symptoms. It can be difficult to ascertain whether it was the treatment that truly impacted the outcomes or disease severity factored into health outcomes, as those with milder symptoms may not have required further treatment.

LIMITATIONS

These results present with some limitations. For this study, we included only oral corticosteroid prescriptions and excluded prednisolone and dexamethasone. Topical corticosteroids are a common treatment for TD; however, for the purposes of this study, we focused on oral corticosteroids prescriptions. Further, we did not evaluate comorbidities, which could impact the duration of corticosteroids such as history of gastrointestinal bleeds or diabetes. Additionally, diagnoses were determined by healthcare insurance claims where some cases may have been missed or misdiagnosed and the primary reason for the follow-up visit could not be ascertained, which could have resulted in some misclassification error or selection bias. Also, claims data does not include years of experience or specific training of the clinician. As the ICD-10 diagnosis includes all plant-related ACD, a small portion of claims may have been for diagnoses other than poison ivy, oak, or sumac. Moreover, the reason of the return visit (eg, acute vs scheduled return) could not be obtained from the claims data. Lastly, the data only represented health claims from adults <65 who were privately insured and may not reflect trends in pediatric (<18 years old) or older adult (>65 years old) populations or those with different or no healthcare coverage.

CONCLUSION

This study was the first to identify treatment patterns for toxicodendron dermatitis for those treated in the ED as well as explore the association between duration of treatment and healthcare utilization outcomes such as return visits. This research revealed that shorter duration oral corticosteroids and treatment received in the ED is associated with an increased risk for return healthcare visits. Most clinicians in the ED currently prescribe oral corticosteroids to TD patients for a duration of less than 14 days. Based on these results emergency physicians could reduce likelihood of ED return visit by adhering to recommendations of 14-21 days of treatment when medically appropriate.[6] Future research should aim to structure interventions targeted at education on the appropriate treatment pathways for TD in order to reduce healthcare utilization associated with sub-therapeutic treatment.

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PRIOR PRESENTATIONS

This work was presented at the 2021 American Contact Dermatitis Society Annual Meeting.

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Caregiver Perceptions Regarding Alternative Emergency Medical Services Dispositions for Children: A Cross-Sectional Survey Analysis

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Introduction: Emergency medical services (EMS) systems have developed alternative disposition processes for patients (including leaving the patient at the scene, using taxis, and transporting to clinics) vs taking patients directly to an emergency department (ED). Studies show that patients favorably support these alternative options but have not included the perspectives of caregivers of children. Our objective was to describe caregivers' views about these alternative disposition processes and analyze whether caregiver support is associated with sociodemographic factors.

Methods: We surveyed a convenience sample of caregivers in a pediatric ED. We asked caregivers 15 questions based on a previously validated survey. We then conducted logistic regressions to determine whether sociodemographic factors were associated with levels of support.

Results: We enrolled 241 caregivers. The median age of their children was five years. The majority of respondents were non-Hispanic Black (57%) and had public insurance (65%). We found that a majority of respondents supported all alternative EMS disposition options. The overall level of agreement for survey questions ranged from 51-93%. We grouped questions by theme: non-transport; alternative destinations; communication with EMS physician; communication with primary care physician and sharing records; restricted EMS role; and shared decision-making. Regression analyses for each theme found that race/ethnicity, public insurance, and patient age were not significantly associated with the level of support.

Conclusion: Most caregivers were supportive of alternative EMS disposition options for children with low-acuity complaints. Support did not vary significantly by respondent race/ethnicity, public insurance status, or patient age. [West J Emerg Med. 2022;23(4)489–496.]

INTRODUCTION

Emergency medical services (EMS) call volumes have increased to more than 20 million annual EMS responses in the United States[1] compared to 17 million calls just 10 years ago.[2] Pediatric transports represent 13% of all EMS transports in the US.[3] Many of these patients may have low-acuity complaints and not need the medical resources associated with an ambulance transport or emergency department (ED) encounter.[4,5] Studies have found that between 10–60% of all EMS transports might be safely transported to alternative destinations other than the ED,[6–8] but this percentage is unknown for pediatric patients. Enabling children with low-acuity complaints to be transported by other means, or seen in healthcare settings other than the ED, could provide more efficient, cost-effective, and patient-centered care.[9]

Industry experts and federal funding agencies have recommended pilot studies of alternative EMS disposition processes.[10,11] *EMS Agenda 2050* envisages that in the future, "EMS and its partner agencies will coordinate to provide the most appropriate care to the patient, with transport to a healthcare facility being just one option."[12] In 2019, the Centers for Medicare & Medicaid Services (CMS) launched the *Emergency Triage, Treatment & Transport (ET3)* model. The *ET3* provides incentives for EMS agencies to develop and assess protocols for Medicare patients so that they may be assessed at the scene (including with the use of telemedicine) and not transported or transported to a primary care office.[13] Research into more flexible EMS delivery and reimbursement processes is a frequently identified priority area for prehospital pediatric research.[14,15]

Successful implementation of alternative EMS disposition processes will require understanding the perspectives of patients and caregivers.[16,17] For example, community engagement and acceptance have been critical in successfully implementing community paramedicine programs.[18–20] A Resource Document for the National Association of EMS Physicians notes that caregiver expectations may preclude including children in alternative disposition programs.[21] Patients have previously been supportive of alternative EMS dispositions, with approval ratings of 50-90%.[22,23] These studies have included limited numbers of pediatric caregivers and non-White respondents. Therefore, we performed this study to address this gap in the literature and capture the perspectives of caregivers of children. Previous studies have described the specific vulnerabilities of young children,[24–27] different levels of trust in the healthcare system by race/ethnicity[28–30] and disparities in EMS care associated with race[31–34] and economic status.[35] We therefore hypothesized that caregivers of young children and those from racial-ethnic minorities would have lower levels of support for alternative EMS processes than was previously described in the literature.

Population Health Research Capsule

What do we already know about this issue?
Adult patients are supportive of alternative EMS dispositions (including leaving at scene, using taxis, and transporting to clinics) for non-emergent calls.

What was the research question?
Are caregivers supportive of including children in alternative EMS disposition programs?

What was the major finding of the study?
Most caregivers are supportive of including children in alternative EMS disposition programs.

How does this improve population health?
Including appropriate children in alternative EMS disposition programs could provide more efficient and patient-centered care.

METHODS

Study Design

We conducted a cross-sectional survey of caregivers presenting to an urban, academic pediatric ED between August 2018–January 2019. This study took place at a freestanding children's hospital with a Level I pediatric trauma center with an annual volume of approximately 90,000 emergency patient encounters. The hospital receives almost all EMS pediatric transports from the District of Columbia, and the majority of pediatric EMS transports from two neighboring counties in Maryland. Our institutional review board approved this study.

Data Source and Collection

We used a previously validated survey developed by Munjal et al[22] with the addition of questions specific to a 911-linked nurse triage line (Supplemental Figure 1). We asked caregivers their level of agreement with 15 statements on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The survey also asked whether the caregiver had called 911 over the prior three years and whether the patient had arrived by ambulance on the date surveyed. Caregivers were eligible for inclusion regardless of mode of arrival. We approached caregivers in the waiting room or clinical exam room after they had completed initial ED triage. Caregivers were approached consecutively during open enrollment periods when research staff were available (Monday-Friday from 8 AM-11 PM, and Saturday-Sunday from 2 PM-10 PM). Research associates (RA) collected the survey responses on an electronic tablet device using REDCap electronic data capture tools hosted at The Clinical and Translational Science Institute (CTSI) at Children's National (Research Electronic Data Capture).[36,37] The RAs then reviewed the patient record to collect additional data, including patient demographics, triage acuity level, and chief complaint. Caregivers provided demographic information to registration staff. The study enrollment workflow is outlined in Supplemental Figure 2. Only IRB-authorized study team members had access to the password-protected and Health Insurance Portability and Accountability-compliant REDCap platform.

Data Analysis

We decided a priori to collect an initial sample of approximately 250 patients to enable us to perform multivariable modeling with 12 predictor variables for the outcome of caregiver agreement (assuming at least 50% respondent agreement). The primary objective of our study

was to describe the overall level of support for specific components of an alternative EMS disposition process. We decided a priori to group "agree" and "strongly agree" responses together. The secondary objective of our study was to determine whether support for components of an alternative EMS disposition process was associated with race/ethnicity or insurance status. We used bivariable regression analyses for each survey question to determine the association with race/ethnicity and insurance status.

We then grouped questions into six themes (non-transport, alternative destinations, communication with EMS clinician, communication with primary care physician and sharing of records, restricted EMS role, and shared decision-making). We repeated the bivariable logistic regression analyses based on respondents who agreed with *all* questions grouped within a theme. We decided a priori to adjust our final multivariable regression models for patient demographic factors, including age, race/ethnicity, gender, insurance status, state of residence, and other patient encounter variables. Other encounter variables included in the regression analysis were as follows: arrival by ambulance on day of survey completion; use of an ambulance in the prior three years; day of week; hour of arrival; and Emergency Severity Index (ESI) triage level on the date of visit. All statistical analysis was conducted using SAS software version 9.3 (SAS Institute Inc., Cary, NC).

RESULTS

We enrolled 241 caregivers. The median patient age was five years (interquartile range 18 months-10 years), and 56% were male. The most common racial/ethnicity responses were non-Hispanic Black (57%) and Hispanic (26%). Most patients were enrolled in public insurance programs (65%). These sample characteristics are similar to overall ED patient demographics at our institution. Almost one-quarter of caregivers stated they had called 911 in the prior three years, while only 14% of respondents had arrived in the ED by ambulance on the day of survey enrollment (Table 1).

Table 1. Selected population characteristics for children of the enrolled caregivers (N = 241).

Characteristic	n (%)
Age category	
Less than 1 y/o	33 (13.7%)
1 y/o to 3 y/o	63 (26.1%)
4 y/o to 6 y/o	51 (21.2%)
7 y/o to 12 y/o	49 (20.3%)
Greater than 12 y/o	45 (18.8%)
Gender	
Female	107 (44.4%)
Male	134 (55.6%)
Race/Ethnicity	
White, Non Hispanic	33 (13.7%)
Black, Non Hispanic	138 (57.3%)
Hispanic	62 (25.7%)
Other	8 (3.3%)
State	
DC	131 (54.4%)
Other	110 (45.6%)
Insurance status	
Private	70 (29.1%)
Public	157 (65.2%)
Not documented	14 (5.8%)
Triage ESI level	
Levels 1 and 2	38 (15.8%)
Level 3	104 (43.2%)
Level 4	85 (35.3%)
Level 5	14 (5.8%)
Arrived via ambulance	33 (13.7%)
Arrived during business hours	118 (49.0%)
Called 911 in the last 3 years	56 (23.2%)

y/o, years old; *DC,* District of Columbia; *ESI,* Emergency Severity Index.

The overall level of agreement for survey questions ranged from 51-93%. For ease of interpretation, we grouped questions into themes that addressed specific components of alternative EMS disposition processes: non-transport; alternative destinations; communication with EMS clinicians; communication with primary care physicians and sharing of medical records; a restricted role for EMS; and shared decision-making. These themes align with those used in previously published literature using this survey.[22] We found the highest levels of support for caregiver involvement in shared decision-making; 93% of respondents agreed with the statement, "I would prefer to be involved in the decision as to if and where my child is to be transported" (Q12). There were also very high levels of support for the sharing of medical records and information; 89% of caregivers agreed with the statement, "When treated by EMS, the EMS professionals should have access to my child's medical history in order to treat them correctly" (Q1), and 87% agreed with the statement "I would feel comfortable with EMS sending information about my child's care electronically to my child's doctor or hospital's health records" (Q13). The statements with the lowest level of support pertained to EMS deciding not to transport a patient, with 51% of caregivers agreeing with the statement "I would prefer my child being treated and allowed to stay at home rather than be transported to the hospital if EMS determines they do not need to go to the hospital" (Q4) (Table 2).

Participants were told that a 911-nurse triage line involves a nurse speaking with parents after they have called 911, to determine whether an ambulance is needed. After hearing this brief description, 61% of caregivers agreed with the statement "I would feel comfortable speaking to the nurse triage line

Table 2. Caregiver levels of agreement to survey items.

Survey questions	% Strongly Agree/ Agree
Non-transport	
Q2 Sometime EMS can treat a child and they no longer need to go to the hospital.	56.0%
Q4 I would prefer my child being treated and allowed to stay at home rather than be transported to the hospital if EMS determines they do not need to go to the hospital.	51.0%
Q7 I want EMS to do an evaluation of my child and then advise me whether they need to go to the hospital.	72.9%
Alternative destinations	
Q3 EMS should have the option to bring children to a primary care office, urgent care center or clinic,	73.9%
Q5 I would prefer my child being taken to a clinic or primary care doctor's office rather than to the emergency room if EMS determines that they do not need to go to the hospital.	57.7%
Q14 I would prefer my child received an urgent appointment at a clinic or primary care doctor's office rather than being transported to the emergency room if the Nurse Triage Line operator determines that they do not need to go to the hospital.	63.1%
Communication with EMS clinician	
Q8 I would feel comfortable speaking to the EMS supervising doctor by telephone and following their advice.	56.4%
Q9 I would feel comfortable speaking to the EMS supervising doctor by videophone and following their advice.	58.5%
Q15 I would feel comfortable speaking to the Nurse Triage Line operator by telephone and following their advice.	61.0%
Communication with primary care physician and sharing records	
Q1 When treated by EMS, the EMS professionals should have access to my child's medical history in order to treat them correctly.	89.2%
Q10 I would feel comfortable if EMS communicated with my child's doctor and together made a decision about my child's treatment and transport destination.	76.4%
Q11 I would feel comfortable if EMS communicated with my child's doctor and together decided my child did not need to be transported.	65.6%
Q13 I would feel comfortable with EMS sending information about my child's care electronically to my child's doctor or hospital's health records.	86.7%
Restricted EMS role	
Q6 EMS should not be restricted to only providing lifesaving treatment.	57.7%
Shared decision making	
Q12 I would prefer to be involved in the decision as to if and where my child is to be transported.	92.9%

EMS, emergency medical services.

operator by telephone and following their advice" (Q15). We found that 63% of caregivers agreed with the statement "I would prefer my child received an urgent appointment at a clinic or primary care doctor's office rather than being transported to the emergency room if the nurse triage line operator determines that they do not need to go to the hospital" (Q14) (Table 2).

We used White, Non-Hispanic, and private health insurance as our reference group in separate bivariable analyses and did not identify any significant association between those variables and caregiver level of support for any survey question. We ran additional bivariable regression analyses for all other covariates and did not find any variables with a significant association with the level of caregiver support. In our adjusted models, we similarly did not identify any patient or encounter variables associated with support for any specific survey question (Supplemental Table 1) or component theme of an alternative EMS disposition process (Table 3).

DISCUSSION

A majority of caregivers in this study were supportive of including children in alternative EMS disposition processes. Our results do not support our hypothesis that child age, race/ethnicity, and insurance status would be associated with the level of caregiver support for any aspect of an alternative EMS disposition process. There is currently very little literature regarding caregiver preferences for alternative EMS dispositions for children and no data regarding caregiver attitudes toward a 911-linked nurse triage line. The levels of support for alternative EMS disposition processes in our study are similar to the findings in previous studies with adults.[22,23] Caregiver support for specific statements in our study ranged from 51.0-92.9%. This is very

Table 3. Factors associated with agreement to all survey items within a theme.

	Non-transport Q2, Q4, Q7 aOR (95% CI)	Alternative destinations Q3, Q5, Q14 aOR (95% CI)	Communication with EMS clinician Q8, Q9, Q15 aOR (95% CI)	Communication with PCP & Sharing Records Q1, Q10, Q11, Q13 aOR (95% CI)	Restricted EMS Role Q6 aOR (95% CI)	Shared Decision Making Q12 aOR (95% CI)
Age category						
Less than 1 y/o	2.7 (1.0, 7.4)	1.6 (0.6, 4.2)	2.7 (1.0, 7.1)	1.0 (0.4, 2.5)	0.4 (0.1, 1.0)	0.4 (0.1, 2.8)
1 y/o to 3 y/o	1.5 (0.6, 3.7)	1.5 (0.6, 3.4)	2.0 (0.8, 4.8)	0.9 (0.4, 2.0)	0.3 (0.1, 0.8)*	0.8 (0.2, 3.9)
4 y/o to 6 y/o	2.1 (0.8, 5.2)	1.8 (0.7, 4.2)	2.8 (1.2, 6.8)*	1.7 (0.7, 4.3)	0.4 (0.2, 1.0)	1.7 (0.3, 11.1)
7 y/o to 12 y/o	1.7 (0.7, 4.3)	1.2 (0.5, 2.9)	1.9 (0.8, 4.8)	1.5 (0.6, 3.6)	0.3 (0.1, 0.8)*	1.2 (0.2, 6.7)
Greater than 12 y/o	Referent	Referent	Referent	Referent	Referent	Referent
Gender						
Female	1.2 (0.7, 2.1)	0.9 (0.5, 1.6)	1.0 (0.6, 1.8)	1.3 (0.7, 2.3)	0.6 (0.3, 0.9)*	1.0 (0.3, 2.8)
Male	Referent	Referent	Referent	Referent	Referent	Referent
Race/Ethnicity						
White, Non Hispanic	Referent	Referent	Referent	Referent	Referent	Referent
Black, Non Hispanic	0.6 (0.2, 1.4)	0.7 (0.3, 1.7)	0.8 (0.3, 1.8)	0.5 (0.2, 1.4)	0.8 (0.3, 1.9)	0.8 (0.1, 5.1)
Hispanic	0.8 (0.3, 2.2)	0.8 (0.3, 2.1)	0.6 (0.2, 1.7)	0.8 (0.3, 2.4)	0.4 (0.1, 1.2)	0.9 (0.1, 7.0)
Other	1.7 (0.3, 8.9)	0.3 (0.0, 1.7)	0.9 (0.2, 4.3)	1.0 (0.2, 6.2)	0.2 (0.0, 1.0)	0.6 (0.0, 8.5)
State						
DC	1.1 (0.6, 2.0)	1.2 (0.7, 2.2)	0.9 (0.5, 1.7)	0.8 (0.5, 1.5)	1.2 (0.7, 2.2)	0.9 (0.3, 2.7)
Other	Referent	Referent	Referent	Referent	Referent	Referent
Insurance status						
Private	Referent	Referent	Referent	Referent	Referent	Referent
Public	0.6 (0.3, 1.2)	0.9 (0.4, 1.8)	0.9 (0.4, 1.7)	0.8 (0.4, 1.8)	1.1 (0.5, 2.2)	0.7 (0.2, 2.6)
Not documented	0.9 (0.3, 3.2)	1.0 (0.3, 3.6)	0.9 (0.2, 2.8)	0.2 (0.1, 0.9)	0.6 (0.2, 2.0)	--
ESI triage level						
Levels 1 and 2	1.9 (0.8, 4.4)	0.9 (0.5, 2.0)	2.0 (0.9, 4.4)	1.3 (0.6, 3.0)	1.9 (0.8, 4.6)	0.5 (0.1, 2.2)
Level 3	1.9 (1.0, 3.5)	1.0 (0.5, 1.8)	1.2 (0.7, 2.2)	1.0 (0.5, 1.8)	1.3 (0.7, 2.3)	0.8 (0.2, 2.7)
Levels 4 and 5	Referent	Referent	Referent	Referent	Referent	Referent
Arrived via ambulance	1.0 (0.4, 2.2)	1.5 (0.7, 3.3)	1.0 (0.5, 2.3)	1.1 (0.5, 2.5)	0.6 (0.2, 1.3)	0.3 (0.1, 0.9)*
Arrived in business hours	1.4 (0.8, 2.4)	1.4 (0.8, 2.4)	1.4 (0.8, 2.4)	1.4 (0.8, 2.5)	0.8 (0.5, 1.4)	1.4 (0.5, 4.2)
Called 911 in the last 3 years	0.6 (0.3, 1.2)	0.5 (0.2, 1.0)	0.8 (0.4, 1.5)	0.5 (0.2, 0.9)*	0.7 (0.4, 1.4)	3.5 (0.7, 17.4)

a/OR, adjusted odds ratio; *CI,* confidence interval; *DC,* District of Columbia; *y/o,* years old; *ESI,* Emergency Severity Index.

similar to the levels of support (48.2- 93.8%) found by Munjal et al when they first developed these survey questions. Furthermore, in both studies the highest levels of support were observed for questions involving shared decision-making and communication and sharing of medical records. In both studies, lowest levels of support were noted for non-transport by EMS.

Previous data from our institution shows significant rates of low-acuity pediatric EMS utilization.[38] This study suggests that, notwithstanding their current utilization rates, caregivers are supportive of alternative EMS processes of care, irrespective of caregiver race/ethnicity, insurance status, and patient age. Possible explanations for this include that an alternative EMS disposition system provides prompt access to a medical expert to assist with triage, transportation, and prompt access to sick-visit appointments. Qualitative research approaches would help to explore further why our patients do not currently make use of these alternatives despite apparent high levels of support for them.

Even though a higher proportion of pediatric EMS calls are for low-acuity complaints than adult EMS calls, children have been excluded from the vast majority of community paramedicine programs[39] and other local initiatives that triage specific EMS calls to sites of care other than the ED.[40–42] A recent study found that 19% of all pediatric 911 calls in the US end with a caregiver refusal of transport.[43] This is substantially higher than the level of patient refusals for adults. Possible reasons for excluding children from EMS-initiated non-transport protocols include the following: children use EMS at lower rates than adults[3]; pilot programs have focused on disease processes more common in adults than children[41,44,45]; difficulty adapting triage criteria to younger (and sometimes non-verbal) patients; and concern about the acceptability of these alternative processes to caregivers.[46] Our study, however, suggests that caregiver support for including children in alternative disposition processes is similar to that reported in adults. Only a slight majority of caregivers, however, supported EMS leaving patients at the scene. Successful implementation of alternative disposition processes for children will require the proposed alternatives to be acceptable to the communities that they are designed to serve. Furthermore, studies will also be needed to ensure that any pediatric protocols are safe (with a low rate of under-triage by EMS) and equitable prior to widespread implementation.

LIMITATIONS

There are several limitations to our study. First, this was a single-center study undertaken in an urban area with most respondents identifying as Black or non-Black Hispanic. These findings should not be applied to other populations. Second, this data was collected before the coronavirus 2019 pandemic. Families and EMS agencies have been eager to reduce unnecessary EMS transports and ED visits during the pandemic,[47,48] which is not captured by our data. Third, the additional questions in our survey relating to a nurse triage line closely mirrored the format of the previously validated survey. We did not, however, separately validate these individual questions.

Additionally, there are specific limitations related to our survey methodology. We may have selection bias, as this was a sample of caregivers in the ED when RAs were available to enroll participants. While our patient sample had similar demographics to overall ED patient data, social factors affecting the use of EMS may be different for children arriving overnight. Low-acuity pediatric EMS calls are more common overnight than during usual office hours.[38,49] This likely reflects lack of other sources of available care overnight. Very few caregivers declined to complete this survey; therefore, we do not believe there is a significant non-response bias. Despite explaining that the research team was not responsible for implementation of alternative EMS disposition protocols, there may be acquiescence bias with caregivers believing the RAs wanted to hear approval of these alternative dispositions. Finally, we asked these questions in the same order, consistent with the previous study that validated the survey. This may have generated question-order bias.

CONCLUSION

Caregiver support for alternative EMS disposition processes for children is similar to published rates for adult patients. We found high levels of support for most components of an alternative EMS disposition process, although almost half of caregivers were opposed to being left at the scene if EMS determined transport was not necessary. Levels of support did not vary significantly with caregiver insurance status or race/ethnicity. Our study directly refutes the assertion that caregiver expectations should automatically preclude children from being included in alternative EMS disposition programs. Further qualitative studies should explore why caregivers have variable levels of support for the component parts of an alternative EMS disposition process. Caregiver perspectives could also be used to develop specific alternative EMS disposition protocols that are patient centered. These protocols would then need to be prospectively evaluated.

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Pediatric Point-of-Care Lung Ultrasonography: A Narrative Review

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Point-of-care lung ultrasonography is an evidence-based application that may play a vital role in the care of critically ill pediatric patients. Lung ultrasonography has the advantage of being available at the patient's bedside with results superior to chest radiography and comparable to chest computed tomography for most lung pathologies. It has a steep learning curve. It can be readily performed in both advanced healthcare systems and resource-scarce settings. The purpose of this review is to discuss the basic principles of lung ultrasonography and its applications in the evaluation and treatment of critically ill pediatric patients. [West J Emerg Med. 2022;23(4)497–504.]

BACKGROUND

Point of care lung ultrasonography has had a vital role in the care of critically ill patients for the past three decades. Currently, many pediatric emergency departments (ED) and intensive care units (ICU) worldwide employ it for patient care. International expert consensus and evidence-based recommendations support the use of lung ultrasound for evaluation and management of a variety of pulmonary pathologies in adult and pediatric patients.[1] We present a review of applications of point of care lung ultrasound (US) in critically ill pediatric patients.

INTRODUCTION

The formation of an image on an ultrasound machine involves generation of sound waves by piezoelectric crystals in the device's transducer. Depending upon the acoustic impedance of the imaged structures, these sound waves are reflected, scattered, absorbed, or attenuated as they pass through different mediums of the body such as soft tissue, air, fluid, or bone.[2] As air is a poor conductor of sound waves, the lungs were traditionally viewed as not suitable for ultrasound imaging. However, lung ultrasound is possible by interpretation of artifacts generated by the pleural line for aerated lungs and by direct visualization for many pathologies.[3]

TECHNIQUE

- *Patient position:* Children are great candidates for lung US due to their thinner chest wall and smaller thoracic width compared with adults. Lung US can be performed with a child in any position (eg, sitting, supine, or in a parent's arms) if appropriate images of bilateral anterior, lateral, and posterior lungs can be obtained. When available, warm gel should be used to increase patient comfort.
- *Probe:* A high-frequency linear probe (7.5-10 megahertz) is often used for lung US in pediatrics, as it offers high-resolution images of the pleural line and lung pathology.[4] A lower frequency phased array or curvilinear probe may be used as well, depending on the patient's body habitus.[1]
- *Probe orientation:* The probe can be placed longitudinally, perpendicular to the ribs, with the probe marker oriented toward the patient's head. For a transverse approach, the probe marker should be placed transversely/obliquely, parallel to the intercostal spaces, with the probe marker oriented toward the patient's right. The longitudinal approach allows visualization of the pleural line between two ribs, whereas the transverse/oblique approach enables increased visualization of pleura without rib interruption.[3]
- *Ultrasound Mode:* B-mode, or two-dimensional scanning, is used most commonly for lung US. M-mode, or motion

mode, can be used for sonographic evaluation of the lung tissue, especially when evaluating for pneumothorax.

- *Scanning sites:* Lung US can only visualize pathology directly under the probe. Therefore, comprehensive scanning includes bilateral anterior, lateral, and posterior lung fields. However, the number of scanning sites can vary depending upon the clinical situation. In a critical care setting, for example, where the patient is supine, only the anterolateral chest may be accessible for scanning. Scanning of costophrenic angles is necessary to evaluate for fluid collection (e.g., pleural effusion or hemothorax).[3]

LUNG SONOANATOMY FINIDNGS

Pleural line: In a well aerated lung**,** the pleural line appears as a hyperechoic line with lung sliding. Lung sliding is the dynamic, horizontal, to-and-fro movement, or shimmering, of parietal pleura over visceral pleura with respiration. The pleural line is part of the bat sign in longitudinal view or can be visualized as an uninterrupted hyperechoic line in the transverse/oblique view (Figure 1). The bat sign consists of three hyperechoic areas: the two hyperechoic curved lines on the sides represent the upper and lower ribs with posterior acoustic shadowing, and the middle hyperechoic line between the ribs represents the pleural line.[2] Clinically significant artifacts produced by pleural line are as follows:

1. *A-lines:* A-lines are static, horizontal hyperechoic artifacts arising from the reverberations produced between the pleural interface and the probe. The distance between each A-line is equivalent to the distance between the ultrasound probe and the pleural line.[5] The A-line profile represents air in the alveolar spaces and is present in normal lungs, hyperinflated lungs, and pneumothorax.[3] (Figure 1).
2. *B-lines:* B-lines or comet tail artifacts are discrete, hyperechoic, vertical artifacts arising from the pleural surface and extending to the bottom of the screen, obliterating A-lines at their intersection. The term lung rockets denote multiple B-lines in a lung scan. The number of B-lines in each intercostal space is related to the extent of fluid in the lungs: <3 B-lines is normal; 3-4 B-lines represent thickened interlobular septa; and >5 B-lines can represent severe interstitial disease[6] (Figure 2A). Although there is no consensus on the physical basis of B-lines in the literature, multiple hypotheses suggest that the B-lines are produced by the acoustic properties of the pleura and a structural change in the geometry and connectivity of sub-pleural air spaces. It is hypothesized that transonic channels are formed by water accumulation in the pulmonary interstitium. These channels, along with the heterogenous collapse of terminal airspace, allow the propagation of US waves that would have been otherwise reflected in normal lungs. [7]

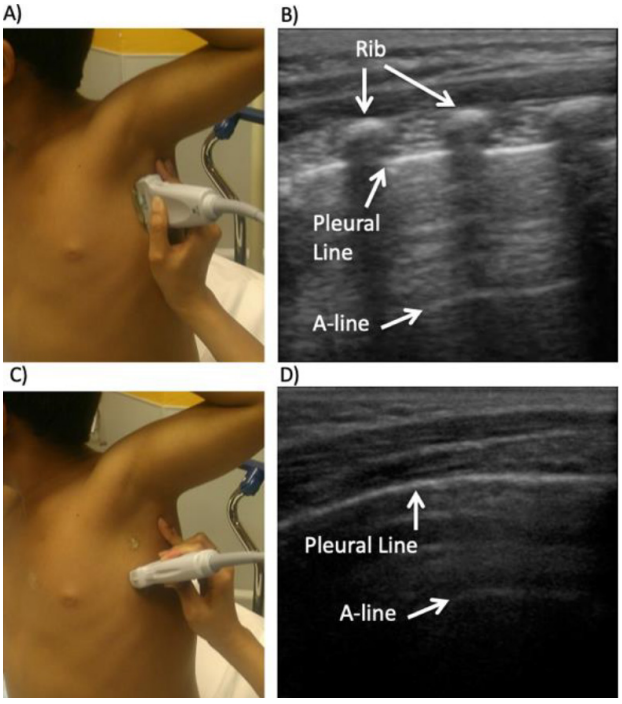


Figure 1. Normal lung ultrasound (US). A) Longitudinal probe positioning for lung US with B) corresponding longitudinal lung US image and bat sign. C) Transverse/ oblique probe positioning for lung US with D) corresponding lung US image.

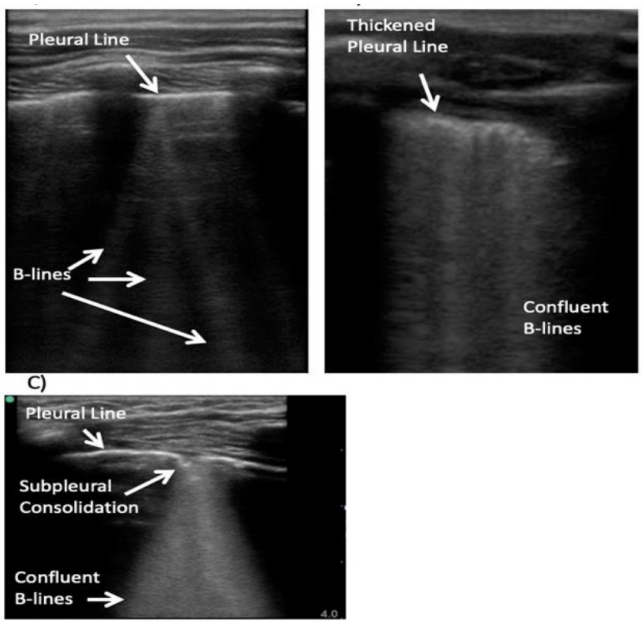


Figure 2. Alveolar interstitial syndrome. A) B-lines originating from the pleural line and extending to the bottom of the screen. B) "Waterfall" sign with confluent B-lines. C) Subpleural consolidation < 1 centimeter with confluent, trailing B-lines.

APPLICATIONS OF POINT-OF-CARE LUNG ULTRASOUND

Lung ultrasonography can be employed for various clinical conditions in the ED and ICU. It is readily available, easy to perform at the bedside, and has a significant advantage of reducing exposure to the ionizing radiation associated with chest radiograph (CXR) and computed tomography (CT). The following are common, evidence-based applications of lung US in children.

Lung Consolidation

Lung US is superior to CXR and comparable to chest CT when employed in the evaluation of pneumonia in children. It has a steep learning curve but can be used in any clinical setting. Lung US may also differentiate between different etiologies of consolidation such as pneumonia, atelectasis, and pulmonary embolism.[1]

Scanning technique: In the evaluation for pneumonia, the sonographic technique begins with scanning the area of interest (eg, location of crackles on physical examination) and then progresses to scan the entire lung bilaterally, as needed. A comprehensive approach to lung scanning includes each intercostal space anteriorly in the mid-clavicular line, laterally in the mid-axillary line, and posteriorly in the paravertebral line.

A study of pediatric patients with pneumonia identified by lung US showed that most consolidations are posterior in location (47%), with 31% anterior and 23% lateral in location. In addition, more lung consolidations were identified in the transverse/oblique view than the longitudinal view (96% vs 86%).[8] Therefore, complete lung scanning protocols with scanning in perpendicular planes are needed to minimize missing lung pathology.

Ultrasound findings: Lung with consolidation appears as a hypoechoic region deep to the pleural line due to the presence of fluid in the lung. Characteristic sonographic features of consolidation include hepatization, shred sign, air bronchograms, and focal/marginal B-lines. In addition, the pleural line may be hypoechoic or fragmented in the area of the consolidation (Figure 3).

1. *Hepatization:* A hypoechoic, homogenous, tissue-like appearance of the lung parenchyma, which corresponds to fluid and loss of aeration in the lung.
2. *Shred sign:* Refers to the irregular deep borders of the hypoechoic consolidation.[9]
3. *Air bronchograms:* Air in the bronchioles within the hepatized lung appear as hyperechoic structures within the hypoechoic, consolidated lung. As airways are patent in pneumonia, the air bronchograms move with breathing, which is known as *dynamic air bronchograms.* The movement of these air bronchograms differentiates a parenchymal disease such as pneumonia from non-patent airways, such as atelectasis.
4. Size of consolidation: A consolidation's size may help differentiate between viral and bacterial etiologies of pneumonia. Viral pneumonia is usually associated with a small consolidation with a median diameter of 1.5 centimeters (cm), while bacterial causes of community-acquired pneumonia generally have consolidation size above 2 cm.[10] A recent study found isolated sub-centimeter consolidations with no evidence of pneumonia on CXR or two-week follow-up. In contrast, sub-centimeter consolidations with large consolidations had the highest rates of definite radiographic pneumonia.[11]

The spleen and air in the stomach below the left diaphragm (Figure 3B) or the thymus in young children in the right upper anterior lung field (Figure 3C) may be mistaken for consolidation. Such errors can be avoided by keeping these potential pitfalls in mind and by paying attention to the location of the diaphragm while scanning the left lower chest.[12] A meta-analysis of lung ultrasonography for the diagnosis of pneumonia has shown better sensitivity and comparable specificity to CXR.[13] Lung US for diagnosis of pneumonia also has the ability to reduce the use of CXRs performed in the ED by 30-60%[14] and decrease length of stay of patients in the ED by 48 minutes.[15]

Alveolar Interstitial Syndrome

Alveolar interstitial syndrome (AIS) can be acute (e.g.,

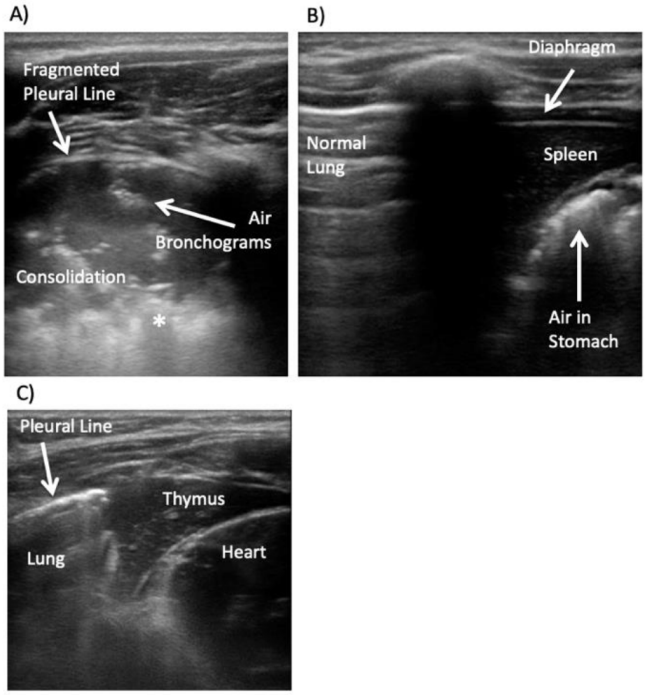


Figure 3. Pneumonia and potential pitfalls. A) Consolidation with fragmented pleural line, air bronchograms, and shred sign (*) consistent with pneumonia. B) Potential pitfalls of lung ultrasound for pneumonia include the spleen and air in the stomach below the diaphragm and C) thymus in the right upper anterior lung field adjacent to the heart in young children.

viral infection, acute respiratory distress syndrome [ARDS], acute pulmonary edema, interstitial pneumonia), or chronic (e.g., pulmonary fibrosis). Point of care lung US is superior to conventional CXR for the diagnosis of interstitial lung disease and may lead to better patient outcomes. [1]

Scanning Technique: While scanning for AIS, it is essential to do a comprehensive scan paying particular attention to the posterior lung bases, as the disease process typically starts there. In the case of limited time and limited patient mobility, scanning may be driven by patient pathology. For example, in a patient with cardiogenic pulmonary edema, scanning should include dependent zones of the lungs while an anterior scan should suffice for a critically ill patient with ARDS.[3]

Ultrasound Findings: AIS is characterized by pleural line abnormalities, the presence of multiple B-lines, and subpleural consolidations (Figure 2B and 2C).

1. *Pleural line abnormalities:* The pleural line can be normal (thin and regular) in cardiogenic causes of AIS, such as cardiogenic pulmonary edema. However, pulmonary causes of AIS (e.g., pulmonary fibrosis, ARDS, pneumonia) produce pleural line abnormalities such as increased thickness, fragmentation, irregularities, and absence of lung sliding due to adherence to exudates.[16]
2. *B- lines:* The presence of >3 B-lines per intercostal space is considered pathological (Figure 2B, 2C). Differences in patterns and uniformity of B-lines can differentiate between different etiologies of AIS. B-lines in a focal pattern can be seen in pathology limited to a specific lung region, such as pneumonia, atelectasis, pulmonary embolism, or neoplasm. In contrast, a more diffuse pattern of B-lines can be visualized in cardiogenic pulmonary edema, ARDS, and pulmonary fibrosis.[6] Confluent B-lines, known as the waterfall sign (Figure 2B), may also occur.

Bronchiolitis

Bronchiolitis is a common pediatric cause of AIS affecting children under 24 months of age, with infants 0-3 months of age having more severe disease. Lung US is more reliable than CXR for bronchiolitis and correlates well with clinical course.[17]

Ultrasound findings: The sonographic signs of bronchiolitis include small subpleural lung consolidations (<1-1.5 centimeters [cm]) (Figure 2C), presence of numerous compact or confluent B-lines defined as white lung, pleural line irregularity and, rarely, minimal pleural effusion or pneumothorax. In one study, lung US identified infants with bronchiolitis in need of supplementary oxygen with a specificity of 99% and sensitivity of 97%.[18]

COVID-19

The coronavirus disease 2019 (COVID-19) pandemic has affected children worldwide and may have pulmonary features visualized on lung ultrasonography.

Ultrasound findings: Lung ultrasonography findings in children with COVID-19 include pleural line irregularities, B-lines (scattered and confluent), consolidations, and pleural effusions.[19,20] In COVID-19, the waterfall sign of confluent B-lines can appear on and off, with normal lung parenchyma in between, representing an early phase of COVID-19 associated ARDS and corresponds with ground-glass opacities seen on chest CT.[21] Newer portable ultrasound machines are easy to disinfect and allow for reduced patient movement between different hospital departments, which is especially important for infection control during the COVID-19 pandemic.[21]

Trauma Applications

Near-drowning

Lung US has a potential role in evaluating drowning or near-drowning victims. Although there are no reported cases of its application in pediatric drowning victims, lung US has been shown to accurately diagnose the cause of acute respiratory failure in an adult patient with accidental near-drowning in seawater.[22]

Lung Contusion

Lung US findings that correlate with a contusion on chest CT include B-lines in a focal lung field,[23] diffuse B-lines or AIS, and C-lines, which are defined as hypoechoic subpleural focal images with our without pleural line gap. In an adult study, lung US performed well compared to the gold standard when evaluating lung contusions. If AIS were considered a diagnostic criterion, lung US had a sensitivity of 95%, specificity of 96%, and accuracy of 95%. If C-lines were deemed diagnostic, the sensitivity and accuracy dropped to 19% and 66%, respectively, but the specificity increased to 100%.[24]

Pleural Effusion

Lung US for diagnosis of pleural effusion is superior to CXR and as accurate as chest CT.

Scanning Technique: The lateral chest is scanned along the posterior axillary line to the diaphragm, which is the most dependent area of the chest in the supine patient.

Ultrasound Findings: Pleural effusion on US is seen as an anechoic or hypoechoic space between the chest wall and lung (Figure 4). Transudative fluid is generally anechoic, whereas internal echoes of the fluid may suggest exudative fluid or hemothorax.

Lung US can accurately quantify the effusion volume and indicate the appropriate location for thoracentesis. Ultrasound-guided chest tube placement in adults has a success rate of 97% and is currently a procedural standard of care in pediatrics.[25]

Pneumothorax

Lung US has been shown to be more accurate than CXR for the diagnosis of pneumothorax and has similar accuracy

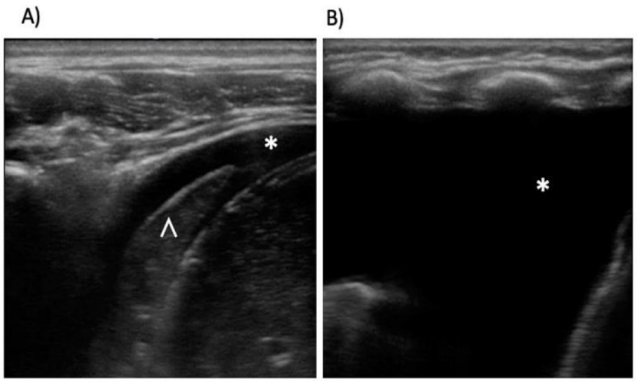


Figure 4. Pleural effusions. A) Small pleural effusion (*) at the costophrenic angle with consolidated lung due to pneumonia (^). B) Moderate-large pleural effusion (*) at the costophrenic angle.

to chest CT. In addition, lung US can differentiate between small and large pneumothoraces. Lung US for diagnosis of pneumothorax is easy to learn and has a steep learning curve.[1]

Scanning technique: As the air in a pneumothorax rises, the least dependent areas of the lung are scanned first. In the supine patient, the second intercostal space in the mid-clavicular line is the least dependent area. Lateral areas of the lung may be scanned to ensure that no pneumothorax is missed, especially if the patient is not supine or flat. Lung US has been shown to have a sensitivity of 98% and specificity of 99% for the diagnosis of pneumothorax in adults.[26]

Ultrasound Findings: Ultrasonographic features of pneumothorax include an absence of lung sliding, presence of A-lines, presence of lung point, and absence of B-lines or lung pulse[1] (Figure 5).

1. *Absence of Lung Sliding*: In pneumothorax, there is a static pleural line without the lung sliding seen in a normal, aerated lung. M-mode can be used to assess aeration of the lung below the pleural line by placing the M-mode scan line perpendicularly through the pleural line. For normal, aerated lung, M-mode shows the *seashore* sign, which is a noisy sonographic tracing below the pleural line. For pneumothorax, M-mode shows the *stratosphere* sign or *barcode* sign, which is as quiet below the pleural line as above.
2. *Lung Point:* The lung point denotes the edge of the pneumothorax and appears at the junction of pneumothorax with normal lung. In B-mode, lung sliding is opposed to the non-sliding pleural line, and in M-mode, the seashore sign is opposed to the stratosphere/barcode sign. The specificity of lung point for the diagnosis of pneumothorax is 100%.[27] However, if the lung point is not visualized, it is generally a larger pneumothorax with a complete collapse of the lung. Therefore, identification of the lung point is not required for the diagnosis of pneumothorax.
3. *Absence of Lung Pulse:* The *lung pulse* is an artifact produced when cardiac pulsations are transmitted to the lung and chest wall.

An algorithm to evaluate for pneumothorax using these sonographic signs is shown in Figure 5C.[1]

Ultrasound of the Diaphragm

Ultrasound of the diaphragm can be used to assess respiratory status. It has been shown to predict non-invasive ventilation failure in neonates[28] and mechanical ventilation weaning outcomes for critically ill children.[29] Recent evidence shows a correlation of diaphragm thickness and excursion with outcomes in patients with bronchiolitis and pneumonia in the ED.[30,31] In addition, ultrasound of the diaphragm may have a role in triaging patients affected by COVID-19 ARDS. It may guide respiratory management decisions such as ventilation and the need for ICU-level care.[32]

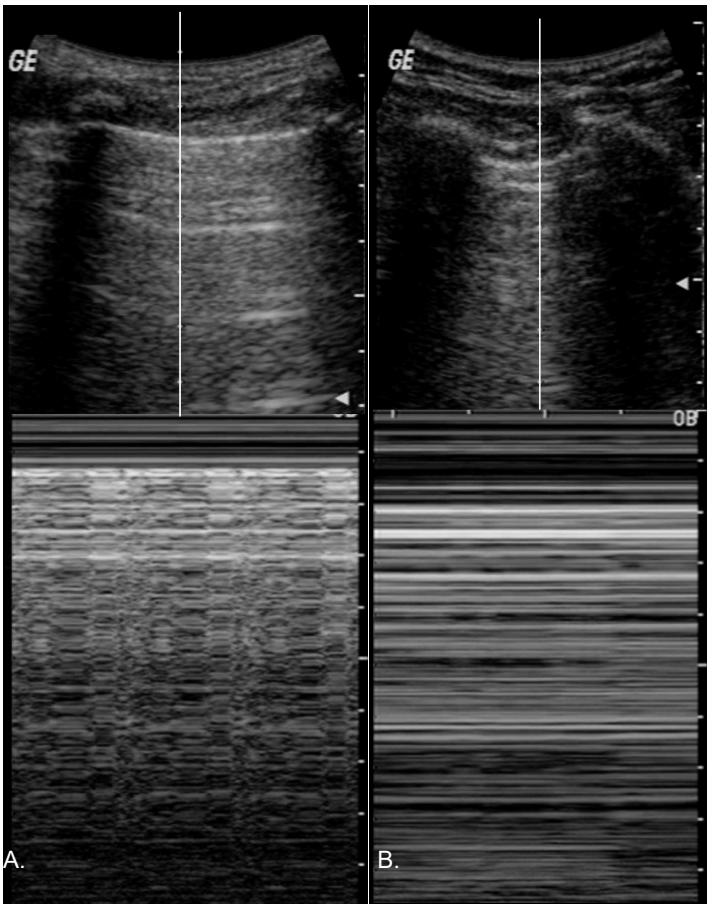
Scanning Technique: For diaphragmatic ultrasound, the phased array or curvilinear probe can be used to assess diaphragmatic excursion and thickness in the subcostal view, with the probe placed in the mid-clavicular line. The linear probe can be used to assess diaphragm thickness in the mid-axillary view (Figure 6).

- *Diaphragmatic excursion:* Diaphragmatic excursion evaluates the movement of the diaphragm with respiration. Diaphragmatic excursion with M-mode through the diaphragm appears as a sinusoidal wave; excursion is measured as the distance from the upward (inspiration) to downward (expiration) deflection, using the average of three breaths during baseline breathing.
- *Diaphragmatic thickness:* Diaphragmatic thickness is defined as the distance between the hyperechoic lines surrounding the diaphragm, which represent the diaphragmatic pleura and peritoneal membrane. The diaphragmatic thickness fraction (DTF) is determined by measuring the diaphragmatic thickness between inspiration when the diaphragm contracts and is at its thickest width (Tdi-Insp) and expiration when the diaphragm relaxes and is at its thinnest width (Tdi-exp) and is calculated with the formula: (Tdi-Insp – Tdi-exp) / Tdi-exp. The DTF has been shown to predict successful weaning of mechanically ventilated pediatric patients with a sensitivity of 82% and a specificity of 81%.[33]

Placement of Endotracheal Tube

Placement of endotracheal tubes (ETT) is common in neonates, children, and adolescents presenting with respiratory failure. Chest radiography is the standard of care for confirmation of ETT placement. However, studies show >90% accuracy for confirmation of ETT placement with ultrasound.[34]

Scanning Technique: The scanning technique for confirmation of ETT placement involves the use of the following windows:



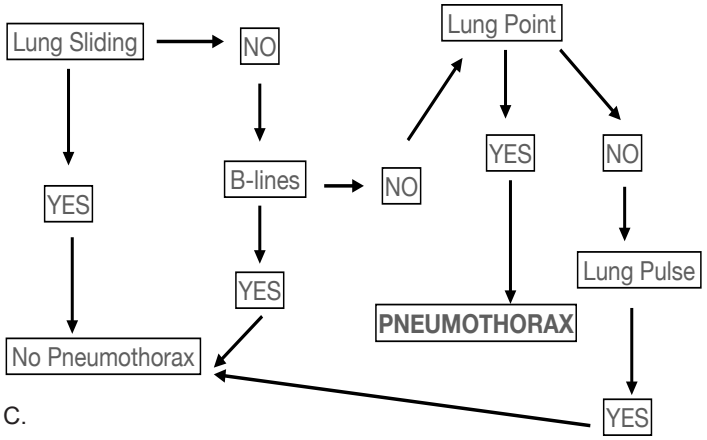


Figure 5. Pneumothorax. A) Normal aerated lung with the "seashore" sign on M-mode. B) Pneumothorax with the stratosphere/"barcode" sign on M-mode. C) Flow chart to evaluate for pneumothorax with lung ultrasound.[1]
US, ultrasound.

- Longitudinal mid-clavicular or mid-axillary intercostal view to confirm lung sliding and aerated lung bilaterally.
- Subcostal views assessing diaphragm motion bilaterally.

Ultrasound Findings: In the case of mainstem bronchus intubation, absence of lung sliding, non-aerated lung, and lack of diaphragmatic movement on the affected side would be seen. There may be a reversal of diaphragmatic movement when positive pressure is delivered to the stomach in esophageal intubation. When the patient is properly ventilated, diaphragmatic excursion will be visualized on M-mode as a sinusoidal wave (Figure 6A).

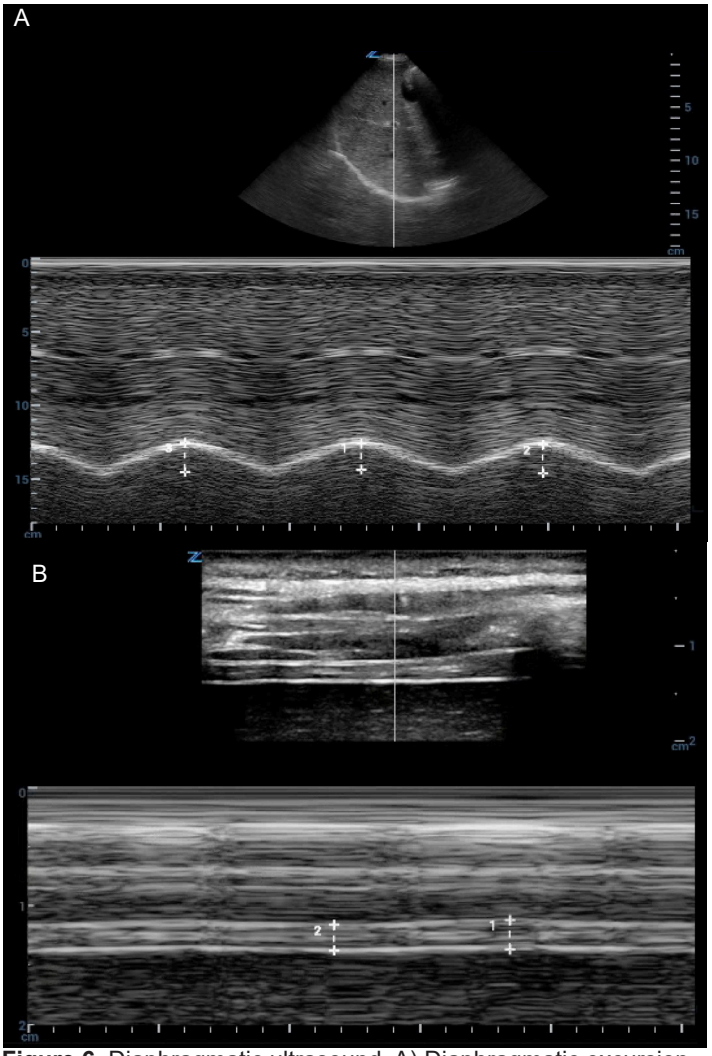


Figure 6. Diaphragmatic ultrasound. A) Diaphragmatic excursion on M-mode in subcostal view at the mid-clavicular line. B) Diaphragmatic thickness on M-mode at the mid-axillary line.

Diaphragmatic excursion for evaluation of proper ETT placement showed a sensitivity of 91% and specificity of 50%. Lung US has also been found to be quicker than conventional CXR (mean 19 vs 47 minutes, respectively) and comparable to capnography for confirmation of ETT placement.[34]

LIMITATIONS

Limitations of lung ultrasonography include operator-dependent scanning skills, patient factors, and pathology factors. Although US is operator-dependent, point of care lung ultrasonography is a technique with a steep learning curve for many applications, novices have been shown to be able to perform lung US with high accuracy,

and there is high interobserver agreement on image acquisition and image interpretation.[35,36] Patient factors that may be limitations for bedside lung ultrasonography include obesity and subcutaneous emphysema. Pathology dependent limitations include etiologies that do not extend to the pleural surface. Therefore, it is important to note that centrally located consolidations, including perihilar or retrocardiac consolidations, that do not extend to the pleural line may be missed on lung US. However, more than 95% of pathological changes have a pleural component in both adults and pediatrics.[37,38] Finally, most studies have a small sample size and compare lung ultrasound to CXR instead of lung CT, which is considered the gold standard in diagnosing respiratory disease. However, the comparison of lung US to lung CT would be unethical due to the risk of radiation exposure.[39]

CONCLUSION

Point of care lung ultrasonography can facilitate early diagnosis of pulmonary pathology and, therefore, improved outcomes[39] in critically ill children. Children are great candidates for lung US due to their thinner chest wall and smaller thoracic width. It has a significant advantage over chest radiograph and CT, including the ability to be performed by the clinician at the bedside and the absence of ionizing radiation exposure, and it has been shown to be more sensitive than CXR and comparable to chest CT in a vast number of pulmonary pathologies. Lung US is beneficial for the diagnosis and management of lung pathology in critically ill children in both well-resourced locales as well as in resource-scarce areas.[40]

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Multisystem Inflammatory Syndrome in Children

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Multisystem inflammatory syndrome in children (MIS-C) is an uncommon but emerging syndrome related to SARS-CoV-2 infection. While the presentation of MIS-C is generally delayed after exposure to the virus that causes coronavirus 2019, both MIS-C and Kawasaki disease (KD) share similar clinical features. Multisystem inflammatory syndrome in children poses a diagnostic and therapeutic challenge given the lack of definitive diagnostic tests and a paucity of evidence regarding treatment modalities. We review the clinical presentation, diagnostic evaluations, and management of MIS-C and compare its clinical features to those of KD. [West J Emerg Med. 2022;23(4)505–513.]

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) cases emerged in the Wuhan Province of China in December 2019 and were later identified in January 2020 in the United States. Following the spread of coronavirus 2019 (COVID-19) globally, there were reported increases in cases of children presenting with prolonged fever, rash, and conjunctivitis similar to Kawasaki disease (KD).[1-3] Several early case reports noted that a few of these affected children progressed to hypotensive shock, myocardial dysfunction, and multisystem organ failure.[4-6] A report from the Royal College of Paediatrics and Child Health in the United Kingdom (UK) noted that this condition was potentially distinct from KD and categorized this presentation as pediatric multisystem inflammatory syndrome.[7-8] A similar description was established by the US Centers for Disease Control and Prevention (CDC), which termed this condition multisystem inflammatory syndrome in children (MIS-C).[9] Both organizations have since provided guidance on case definition, evaluation, and management.

Children with MIS-C often present with fever, cough, upper respiratory symptoms, and gastrointestinal symptoms such as vomiting and diarrhea.[10] We review the epidemiology and clinical presentations of MIS-C, compare and contrast the clinical features of KD and MIS-C, and discuss management options for clinicians who may encounter MIS-C presentations in a clinical setting.

METHODS

Literature Review

In October 2020 we performed a literature search on PubMed along with a web-based search engine using the following Medical Subject Heading terms (performed October 2020): pediatric case reports COVID-19, Kawasaki disease, COVID-19, multisystem inflammatory syndrome in children, pediatric multisystem inflammatory syndrome, and SARS-CoV-2. This search produced 801 records that included scientific articles, editorials, and CDC reports. The sources were reviewed for articles that presented cases with etiology, management plan, treatment, and outcomes as the inclusion criteria for this systemic review. Excluded were records (n = 756) in other languages or without an abstract, review articles, adult-focused articles, pure KD articles, and non-relevant sources. We assessed only full-text articles for eligibility, and 11 studies were chosen for detailed review. The articles were reviewed by pediatric emergency physicians, who selected the articles based on the above inclusion and exclusion criteria. Figure 1 below depicts the PRISMA flow chart obtained from this review.

RESULTS

Epidemiology

The first case of MIS-C was reported in the UK in April 2020.[11] By May 15, 2020, the European Centre for Disease Control and Prevention reported 230 suspected MIS-C cases in 11 European countries. These included the UK, Spain, France, and Italy, along with an additional 12 cases in Canada.[12] By October 4, 2021, a total of 5217 patients had met the case definition for MIS-C, and 46 deaths related to this condition were reported in the United States.[13]

Early cases of MIS-C were initially described in the UK, the Bergamo region of Italy, Paris, and New York City.[14-17] The median age reported was 7.9 years old, ranging from 1-17 years old.[17] Most children with severe symptoms of MIS-C were healthy prior to the onset of disease, with asthma and obesity reported as the most common comorbidities.[18] While initial reports noted a predilection for male gender, subsequent case series with larger sample sizes revealed no significant gender predominance. It is unclear whether the risk of developing MIS-C varied by race, but children and adolescents of African descent represented a disproportionately higher number of cases in the initial UK and French reports.[17-18] In the United States, Black and Hispanic children and adolescents were disproportionately affected by MIS-C, while those of Asian descent comprised a very small minority.[18]

Etiology

While no direct causal relationship between COVID-19 and MIS-C has been identified, the history of exposure to COVID-19 and the epidemiological spike in cases of MIS-C cases in areas with a high incidence of COVID-19 suggests that the two diseases may be related.[19] Postulated mechanisms are that SARS-CoV-2 may trigger an exaggerated immune response to the virus among genetically predisposed individuals or may trigger a cytokine-mediated storm.[20] The suggested hyperactive immune response is characterized by the release of interferons, interleukins, tumor-necrosis factors, and several other mediators as part of innate immune response for clearance of the viral infectious agent.[21]

Multisystem inflammatory syndrome in children has been proposed as a post-infectious process occurring during the development of acquired immunity. This concept is supported by the observation that each surge of cases occurring regionally follows the peak of acute COVID-19 infections by 2-4 weeks. The majority of these children had a negative SARS-CoV-2 polymerase chain reaction (PCR) test but a positive immunoglobulin G (IgG) serology, although some had both positive IgG serology and positive PCR tests.[22] The overt immune response exaggerated by SARS-CoV-2 infection has been theorized to prompt other environmental insults to cause MIS-C in predisposed children and adolescents. A

Population Health Research Capsule

What do we already know about this issue?
Multisystem inflammatory syndrome in children (MIS-C) is a rare and serious emerging manifestation of SARS-CoV-2 as a late immune response diagnosed clinically.

What was the research question?
We review MIS-C presentation, evaluation and management, and compare its features to the similar inflammatory syndrome such as Kawasaki Disease (KD).

What was the major finding of the study?
MIS-C will require early recognition and initiation of therapy. With a need for monitoring in an intensive care unit, and depending on the severity of the illness and organ system involvement, a multidisciplinary team of specialists need to be on hand during supportive care.

How does this improve population health?
This review will aid in its prompt recognition and enable the early initiation of therapy, which has been shown to reduce its morbidity and mortality in all age groups.

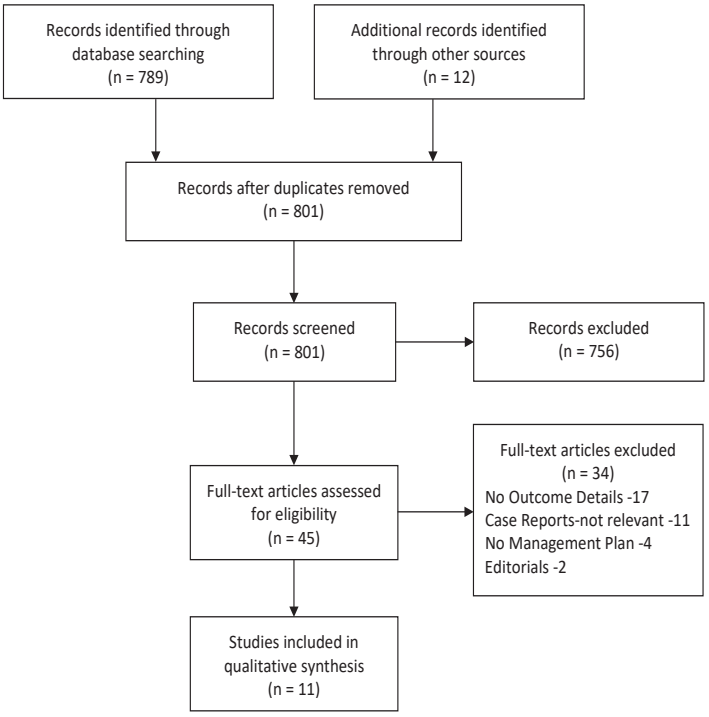

Figure 1. PRISMA flow chart.

similar mechanism has been proposed as a trigger for KD in the past.[23]

Clinical Presentation

The most significant clinical features in children with MIS-C are cardiovascular manifestations. Published case studies have reported shock as the initial presentation in at least 50% of cases.[11,14-18,24-26] Patients with MIS-C have been found to present with cardiac abnormalities on echocardiograms such as ventricular dysfunction, coronary dilation, aneurysms, and/or pericardial effusion. Coronary artery changes were reported in 5-48% of patients with MIS-C, while the literature reported lower rates in KD at 20-25%.[27] Alternatively, about 5% of KD patients presented in shock,[27] and cardiovascular health in KD patients returned to normal after a few months.

Published case series of MIS-C in the US and Europe have demonstrated common features with KD. Fever is present in all patients with MIS-C with a median duration of 4-5 days.[16,25,28-30] Patients with KD have fever for five days or longer, although some patients with atypical KD may have fever for a shorter duration. Respiratory symptoms including cough, congestion, sore throat, and dyspnea were reported in 41-66% of cases.[16,18,25] While irritability occurred in both MIS-C and KD, other neurologic features of MIS-C included headaches and confusion. [11,14-16,18,25,30].

Gastrointestinal symptoms occurred frequently in MIS-C and less commonly in patients with KD. Most MIS-C case series reported that at least 80% of children with MIS-C presented with abdominal pain, diarrhea, and/or vomiting.[11,14-16,18,25,26,30-32] Coronary artery changes were reported in 5-48% of patients with MIS-C, while the literature reported lower rates in KD at 20-25%. Long-term effects of KD (heart valve dysfunction, arrhythmia, coronary artery aneurysms) were rare, and less than 3% persisted into adulthood.[33]

Skin rashes in MIS-C exhibited variable distribution and presented as maculopapular, scarlatiniform, diffuse erythroderma, or erythema multiforme (Table 1). Patients also had mucosal changes such as cracked, swollen, or erythematous lips, strawberry tongue, or pharyngeal erythema. Additionally, edema of the hands and/or feet were sometimes present. Bilateral and non-exudative conjunctival injection with limbic sparing was also reported. Anterior cervical lymphadenopathy, which is one of the diagnostic features of KD, was also seen in MIS-C but was less common.[14,16,22,30-32]

Table 1. Clinical characteristics reported in multisystem inflammatory syndrome in children.

Symptoms
Persistent fever
Rash
Vomiting/diarrhea
Abdominal pain
Headache
Cough/shortness of breath
Irritability
Physical Findings
Rash: maculopapular, erythroderma, erythema multiforme-like
Conjunctivitis: non-purulent, bilateral, bulbar with limbic sparing
Lip swelling or cracking
Strawberry tongue
Palm/sole erythema and/or swelling with or without desquamation

MIS-C, multisystem inflammatory syndrome in children.

Evaluation

The diagnostic evaluation of MIS-C herein described is geared toward rapidly identifying life-threatening conditions that require prompt intervention. It is focused on recognizing the constellation of symptoms and findings that are consistent with this syndrome, while concurrently exploring the possibility of alternative diagnoses. In the setting of this emerging new syndrome and the possibility of rapid clinical deterioration, a high index of suspicion should be maintained when evaluating children with fever. This is especially the case when coupled with abdominal symptoms or other features commonly observed in children with KD.[32] Due to widespread quarantine restrictions and school closures during the COVID-19 pandemic, the incidence of infectious etiologies resulting in prolonged fevers decreased significantly. Heightened awareness of MIS-C has led many practitioners to initiate diagnostic evaluations sooner in the course of febrile illnesses.

The CDC guidelines for identifying suspected MIS-C cases have been described as follows: 1) An individual aged <21 years presenting with fever (greater than or equal to 38°C or a subjective fever lasting more than 24 hours), laboratory evidence of inflammation (elevated C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), fibrinogen, procalcitonin, D-dimer, ferritin, lactic acid, lactate dehydrogenase (LDH), interleukin-6 (IL-6), elevated neutrophils, reduced lymphocytes, low albumin), and evidence of clinically severe illness requiring hospitalization, with multisystem (greater than two), organ involvement (cardiac, renal, respiratory, hematologic, gastrointestinal, dermatologic or neurological); 2) AND no alternative plausible diagnoses; 3) AND positive for current or recent SARS-CoV-2 infection by PCR, serology, or antigen test; or COVID-19 exposure within the four weeks prior to the onset of symptoms.[9]

Common laboratory and diagnostic tests are combined with additional testing directed at identifying a hyperinflammatory state, examining end-organ dysfunction,

and exploring infectious etiologies to evaluate children with clinical suspicion of MIS-C. A complete blood count and comprehensive metabolic panel is obtained to evaluate for infectious and inflammatory states, metabolic derangements, renal or hepatic dysfunction, and disease processes associated with hypotension and hypoperfusion. Testing for COVID-19 via SARS-CoV-2 PCR should also be performed. Since MIS-C is believed to potentially be antibody mediated, the presence of serum antibodies to COVID-19 should also be determined to aid in confirming the initial suspicion of viral exposure.

A urinalysis may be used to identify the presence of sterile pyuria associated with KD.[30] Venous blood gas sampling may be useful in determining acid-base status. White blood cell counts with differential, procalcitonin and lactate level determinations can help identify a systemic bacterial infection and sepsis. Inflammatory markers such as CRP, ESR, ferritin, fibrinogen, D-dimer, and a cytokine panel including IL-1 and IL-6 can be used to distinguish among various types of hyperinflammatory processes. Troponin-I and brain natriuretic peptide (BNP) can be used to assess for cardiac involvement and dysfunction.[7] In KD, platelet counts rise after day 5 of illness, whereas in MIS-C there is typically a drop in the platelet count.[14] Laboratory findings that are associated with MIS-C are listed in Table 2, below, as an initial laboratory set followed by secondary and confirmatory tests.

Other components of evaluation include an electrocardiogram (ECG), chest radiographs (CXR), and point-of-care ultrasound (POCUS). In addition to serum evaluation for troponin-I and BNP, an ECG is performed to evaluate for cardiac dysfunction and acute myocarditis, manifested by sinus tachycardia, alterations in the PR interval, as well as findings consistent with myocardial damage including diffuse ST changes. The CXRs are used to evaluate for pulmonary infiltrates consistent with acute bacterial pneumonia, acute respiratory distress syndrome, or acute COVID-19 respiratory disease. The POCUS cardiac evaluation may be useful in evaluating global function, which is diminished in myocarditis associated with MIS-C. In addition, changes in the expiratory and inspiratory diameter of the inferior vena cava are indicative of disseminated or cardiogenic shock.[33,34]

Management

The management of MIS-C in the ED begins with the overall evaluation and classification of the patient into categories based on symptom severity: mild, moderate, or severe. Current treatment of children with severe presentation consists of supportive care with fluid resuscitation and inotropic support, along with directed therapy for respiratory failure, cardiac dysfunction, a hyperinflammatory state, and evaluation for possible thrombosis. In our review, the use of immunoglobulins, corticosteroids, or anticoagulants may be indicated based on the clinical symptoms and the presence of elevated serum inflammatory markers. Application of antiviral and immune modulator therapy remains variable. Early management strategies should be developed in consultation with experts in pediatric infectious disease, intensive care, cardiology, rheumatology, and hematology. Table 3 below includes a summary of early pediatric MIS-C case series with information on clinical presentation, as well as treatment agents used by the authors listed.

Admission Criteria

Clinicians should maintain a high level of suspicion for MIS-C in children with known or suspected COVID-19 infection who develop fever for several days with no identifiable cause or who have developed shock. Hospitalization may be necessary for patients with suspicion for MIS-C who have significantly elevated serum inflammatory markers, even if symptoms are mild, as some patients may rapidly decompensate and require aggressive resuscitation. Patients who are ill appearing, hemodynamically unstable, require invasive respiratory support, or have evidence of end-organ dysfunction should be admitted to a pediatric critical care unit.

Shock

Patients with severe MIS-C can develop hemodynamic instability from cardiac dysfunction, as well as a decrease in peripheral vascular resistance. Furthermore, secondary bacterial infection can also lead to sepsis and hypotension. Many children with COVID-19-related MIS-C have presented with shock. In several reports, clinical deterioration occurred rapidly; therefore, the importance of continuous monitoring with frequent blood pressure measurements cannot be overemphasized. Hemodynamic instability should be treated according to established pediatric septic shock guidelines.[35] Intravenous fluid resuscitation up to 40-60 milliliters per kilogram (mL/kg) in boluses (10-20 ml/kg per bolus) over the first hour with crystalloid fluids should be infused rapidly and titrated to clinical effect. Consider early initiation of inotropic and vasoactive medications for persistent hypotension refractory to fluid resuscitation. Epinephrine and norepinephrine are the preferred initial agents for patients with myocardial dysfunction or decreased systemic vascular resistance, respectively.[35] Patients with moderate to severe ventricular dysfunction may also benefit from treatment with milrinone and dopamine or dobutamine. Extracorporeal membrane oxygenation (ECMO) may be required in patients with persistent cardiogenic shock refractory to all other treatments. Among the case studies that were reviewed, 11 (9.5%) patients with MIS-C had a presentation of cardiac dysfunction that required ECMO.[16]

Intravenous immune globulin (IVIG) has been used as a first-line treatment in most cases of MIS-C with an overall improvement in cardiac function and decreased inflammatory state. Patients in some case reports with IVIG resistance received a second dose of IVIG, with or without corticosteroids.[15,18,30]

Table 2. Laboratory findings in cases of multisystem inflammatory syndrome in children. Range of mean values reported in currently available literature.

Laboratory test	Result value	Reference range	Admission criteria for MIS-C
Initial laboratory set			
Complete blood count			
White blood cell (per mm^3)	9.7 – 17.4	4 - 13.5	Increased
Hemoglobin (g/L)	84.5 – 110	111-147	Decreased
Neutrophil count (per mm^3)	10,955 – 16,000	1,800 - 7,800	> 10,900
Lymphocyte count (per mm^3)	407 – 1,150	1,000 - 4,800	< 1,000
Platelets (per m^3)	123 – 499	150 - 350	< 150
Comprehensive metabolic panel			
Sodium (mmol/L)	130 – 131	136-146	< 135
Creatinine (umol/L)	63 – 97	62-133	Mild increase
Albumin (g/dL)	2.1 – 3.2	3.5-5.0	< 3.5
AST (IU/L)	57 – 112	10 - 59	Mild increase
ALT (IU/L)	27 – 119	29 - 33	Increased *
C-reactive protein (mg/L)	229 – 301	0 - 5	Increased *
Erythrocyte sedimentation rate (mm/h)	67 – 72	0 – 30	Increased
Secondary laboratory set			
Lactate dehydrogenase (U/L)	363 – 810	45-90	Increased
Procalcitonin (ng/mL)	14 – 46	< 0.15	Increased
Venous blood gas lactate (mmol/L)	2.8 - 3.6	0.5 - 2.0	> 2.0
Ferritin (ng/mL)	610 – 1,857	12 - 200	Increased
Fibrinogen (mg/dL)	313 – 720	200 - 400	Increased
D-dimer (ng/mL)	2,563 – 4,025	< 500	> 1000 *
IL-6 (pg/mL)	170 – 296	< 1.8	Increased
Troponin-I (ng/mL)	0.045 – 282	< 0.35	Increased
Brain naturetic peptide (pg/mL)	788 – 23,093	< 100	> 100

Reference ranges were obtained from Nelson, *Textbook of Pediatrics* (19th edition).
*Indicates lab values that are significant in Kawasaki disease.

MIS-C, multisystem inflammatory syndrome in children; *per mm^3,* per million cubic meters; *g/L,* grams per liter; *per m^3,* per cubic meter; *mmol/L,* millimoles per liter; *umol/L,* micromoles per liter; *g/dL,* grams per deciliter; *IU/L,* international units per liter; *mm/h,* millimeters per hour; *mg/L,* milligrams per liter; *U/L,* units per liter; *ng/mL,* nanogram per milliliter; *mg/dL,* milligrams per deciliter; *ng/mL,* nanograms per milliliter; *pg/mL,* picograms per milliliter.

In children who are ill-appearing with fever, hypoxia, and hemodynamic instability, IV fluids should be initiated immediately, and the child should be admitted to a critical care unit. A CXR is recommended initially to identify interstitial pneumonia and cardiac enlargement. Shock evaluation should include an ECG and echocardiogram to evaluate ventricular function.

Patients who have features of MIS-C without shock or cardiovascular dysfunction (fever, rash, lymphadenopathy, increased CRP/ESR, thrombocytopenia, lymphopenia) should be evaluated with both a laboratory panel and a cardiac evaluation (ECG, echocardiogram). It is recommended that these patients should be admitted to an inpatient unit.

Patients with clinical manifestations and abnormal laboratory findings consistent with MIS-C should be hospitalized for close monitoring and supportive care**.** Children with severe MIS-C disease and those with hypotension or shock requiring vasopressor support should be admitted to the pediatric intensive care unit. A multidisciplinary team approach involving cardiology, infectious disease, immunology, rheumatology, hematology, and intensive care can be helpful in optimizing patient outcomes in an inpatient setting. Thus far, the long-term impact and sequelae among survivors are not known, and careful long-term follow-up is needed to assess future cardiac function.

Table 3. Case series of pediatric multisystem inflammatory syndrome in children (MIS-C). Summary of currently published data of MIS-C patient presentations, treatments, and outcomes. Cardiac involvement includes myocarditis and ventricular dysfunction. Anticoagulation was administered as heparin or enoxaparin.

	Case series Pediatric MIS-C						
	Verdoni et al[15]	Grimaud et al[31]	Belhadjer et al[18]	Riphagen et al[11]	Toubiani et al[30]	Waltuch et al[17]	Cheung et al[16]
Country	Bergamo, Italy	Paris, France	France, and Switzerland	London, UK	Paris, France	New York, USA	New York, USA
Number of patients	10	20	35	8	21	4	17
Median age (years)	7.5	10	10	8	7.9	11	8
COVID-19 PCR or Antibody positive	8 (80%)	19 (95%)	31 (88.5%)	2 (25%)	19 (90%)	4 (100%)	17 (100%)
Classic Kawasaki features	5 (50%)	0	0	0	11 (52%)	0	8 (47%)
Atypical Kawasaki features	5 (50%)	20 (100%)	12 (34%)	8 (100%)	10 (48%)	3 (75%)	5 (29%)
Mechanical ventilation	-	8 (40%)	22 (62%)	5 (63%)	11 (52%)	1 (25%)	0
Shock	5 (50%)	20 (100%)	28 (80%)	8 (100%)	12 (57%)	4 (100%)	13 (76%)
Cardiac involvement	6 (60%)	20 (100%)	35 (100%)	7 (88%)	16 (76%)	4 (100%)	11 (65%)
IV immune globulin	10 (100%)	20 (100%)	25 (71%)	8 (100%)	21 (100%)	3 (75%)	13 (76%)
Corticosteroids	8 (80%)	20 (100%)	12 (34%)	5 (63%)	10 (48%)	-	15 (88%)
IV antibiotics	-	-	-	8 (100%)	18 (86%)	4 (100%)	-
Vasoactive agents or inotropes	2 (20%)	19 (95%)	28 (80%)	8 (100%)	15 (71%)	4 (100%)	10 (59%)
Acetylsalicylic acid	2 (20%)	-	-	6 (75%)	21 (100%)	-	4 (24%)
Anticoagulation	-	-	23 (65%)1	-	-	3 (75%)2	10 (59%)
Immune modulator	0	2 (10%)	3 (8%)	-	-	4 (100%)	1 (6%)
Blood cultures	All sterile	All sterile	-	7 (88%) sterile	All sterile	All sterile	-
ECMO	-	0	10 (28%)	1 (13%)	-	-	-
Fatality	0	0	0	1 (13%)	0	0	0
Coronary artery abnormalities coronary dilations coronary aneurysms	0 2 (20%)	0 0	6 (17%) 0	1 (13%) 0	5 (24%) 0	2 (50%) 0	0 1 (6%)
Median PICU LOS, days	-	4 (1-8)	7 (7-10)	5 (4-6)	5 (3-15)	-	6.4 (3-12)
Hospital LOS	-	-	10 (8-14)	-	8 (5-17)	-	7.1 (3-18)

MIS-C, multisystem inflammatory syndrome in children; *COVID-19 PCR,* coronavirus disease 2019 polymerase chain reaction; *IV,* intravenous; *ECMO,* extracorporeal membrane oxygenation; *PICU,* pediatric intensive care unit; *LOS,* length of stay.

Differential Considerations

Other differential diagnoses to consider are related to bacterial and viral infection. Staphylococcal and streptococcal toxic shock syndrome (TSS) present with fever and shock, and both can present with rash/conjunctivitis, gastrointestinal symptoms (abdominal pain, diarrhea) as a close resemblance to MIS-C, whereas the latter will have cardiac and respiratory features.[36] While streptococcal infections can demonstrate a strawberry tongue, which can be seen in MIS-C and KD, the lips are usually normal, and the oropharynx demonstrates tonsillar exudate and palatal petechiae.

Common viral infections such as enterovirus, adenovirus, parvovirus, and measles can mimic some features of MIS-C including fever, rash, and conjunctival injection. Gastrointestinal symptoms such as abdominal pain, vomiting, and diarrhea may be present in MIS-C, but can also be commonly associated with adenovirus, enterovirus, rotavirus, and Norwalk virus. Epstein-Barr virus (EBV) can cause multisystem organ failure in the central nervous system, liver, lungs, and heart by inciting a hyperinflammatory state similar to MIS-C.[36] Cardiac dysfunction and myocarditis leading to heart failure may be caused by parvovirus, adenovirus,

human immunodeficiency virus, influenza, echovirus, coxsackieviruses, EBV, and cytomegalovirus.

Additional Immune Modulators

One of the clinical features and potentially poor prognostic indicators of MIS-C is markedly elevated inflammatory markers and pro-inflammatory cytokines. The efficacy of immune modulatory therapies such as IL inhibitors (IL-1, IL-6), corticosteroids, or convalescent plasma from patients who have already recovered from COVID-19 remains unclear for patients suffering from MIS-C. Anakinra, an IL-1 receptor antagonist, has been used successfully in the treatment of highly refractory KD.[3,37-39] Belhadjer et al reported that three children with COVID-19-related MIS-C cardiac dysfunction were successfully treated with anakinra for persistent severe inflammatory state.[18] According to Waltuch et al one patient was treated with both anakinra and tocilizumab, an IL-6 inhibitor for atypical KD presenting with TSS features.[33] Four patients had evidence of MIS-C cytokine release syndrome (cytokine storm and significantly elevated levels of IL-6) and they received tocilizumab, an IL-6 inhibitor.[16,33)]

Convalescent plasma has been used in a small number of children with SARS-CoV-2 infection with some beneficial results, although its effectiveness is unclear in patients with MIS-C.[40] Anakinra and tocilizumab may be alternative options in children with severe MIS-C and in patients with markedly elevated pro-inflammatory cytokines, who do not respond to IVIG and corticosteroid treatment.[39] Management options should be discussed in consultation with pediatric rheumatology and immunology healthcare professionals. Responses to treatments include the normalization of vital signs, the resolution of symptoms, and a decrease in inflammation.

Anticoagulation Therapy

Acute infection with SARS-CoV-2 has been associated with an increased risk for thrombotic complications due to an amplified inflammatory response and a state of hypercoagulation.[41] Anticoagulation therapy has been recommended for patients with elevated D-dimer levels or evidence of thrombosis. Currently, there are no definitive guidelines for anticoagulation therapy in children with MIS-C. Patients with either typical or atypical KD should be treated with acetylsalicylic acid. Additional anticoagulation therapy with either a second antiplatelet agent or a systemic anticoagulant (low molecular weight heparin or warfarin) is warranted in children with evidence of medium to large coronary artery aneurysms or existing thrombosis.[3] Anticoagulation therapy should also be considered for children with MIS-C and myocardial dysfunction, or cytokine release syndrome. A case-by-case management plan should be developed in consultation with pediatric hematology professionals.

Antiviral Therapy

While some children with MIS-C have evidence of acute SARS-CoV-2 infection at the time of diagnosis, a large number of children have tested negative on PCR and are positive for serum COVID-19 antibodies. Therapy with the antiviral agent remdesivir has been used in ≥12 years patients with severe complications from acute SARS-CoV-2 infection. However, the risks and benefits of this antiviral treatment remain uncertain. Its benefit is not indicated as MIS-C is considered an immune-mediated phenomenon that occurs weeks after a primary SARS-CoV-2 infection. Consultation with pediatric infectious disease and critical care experts on the use of remdesivir is recommended if suspected or confirmed MIS-C patients are not responding to other treatment options.

Prognosis and Follow-up

Published management guidelines for MIS-C emphasize both short- and long-term follow-up for MIS-C patients who were admitted to the hospital. Close follow-up is recommended for all patients with KD features, cardiac dysfunction, or evidence of coronary artery abnormalities. Repeat echocardiograms should be obtained to screen for coronary artery dilation, aneurysm, and thrombus formation. Patients should be followed up by a primary care physician within a week after discharge from the hospital. Furthermore, follow-up with specialists in infectious disease and rheumatology should also be considered.

DISCUSSION

Multisystem inflammatory syndrome in children differs from other inflammatory disorders such as KD by its novelty in clinical presentation and patient demographics. The number of COVID-19 cases in children continues to rise, with new variants emerging frequently. With this rise in pediatric COVID-19 cases is an expected rise is MIS-C cases; however, the effect of new SARS-CoV-2 variants on the development and progression of MIS-C is unknown. The need for strict MIS-C identification and management guidelines is thus imminent. Mild to severe cases with cardiac dysfunction require early recognition and management for successful prognostic outcome, and for the majority of patients outcomes are generally good with little to no significant medium- or long-term sequelae.[42] Vaccinations are now approved for younger individuals; however, the impact of this intervention on the development of MIS-C following another COVID-19 surge is unclear.

LIMITATIONS

Multisystem inflammatory syndrome in children is a relatively new condition; thus, there is limited literature available to review. As the pandemic evolves and additional waves of infection spread, the identification and management of MIS-C will continue to change. We

have attempted to identify the highest quality published evidence and methodology described within this small pool of limited literature. Hence, it has been difficult to draw any definitive conclusions regarding the overall generalizability of our findings.

CONCLUSION

Multisystem inflammatory syndrome in children should be suspected in children presenting with fever and the symptoms described above following the diagnosis of, or exposure to, SARS-CoV-2. Kawasaki disease has similar clinical characteristics when compared to MIS-C. Early recognition and testing of suspected MIS-C patients will result in earlier treatment initiation and will likely limit the patient's generalized immune-mediated decline. Managing children with respiratory and cardiovascular dysfunction requires caution and continued surveillance. Long-term studies are required to determine the association of MIS-C with COVID-19 infection and the effect of COVID-19 vaccination on MIS-C, and to understand the effect of new SARS-CoV-2 variants on the development and progression of this condition.

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Physician Pipeline and Pathway Programs: An Evidence-based Guide to Best Practices for Diversity, Equity, and Inclusion from the Council of Residency Directors in Emergency Medicine

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Improving the diversity and representation in the medical workforce requires intentional and deliberate efforts to improve the pipeline and pathway for underrepresented in medicine (UIM) applicants. Diversity enhances educational experiences and improves patient care and outcomes. Through a critical review of the literature, in this article we offer evidence-based guidelines for physician pipeline and pathway programs (PP). Recommendations are provided regarding considerations on the types of programs and surrounding implementation to ensure a sound infrastructure and framework. We believe this guide will be valuable for all leaders and faculty members seeking to grow the UIM applicant pool in our efforts to advance diversity, equity, and inclusion within medicine. [West J Emerg Med. 2022;23(4)514–524.]

BACKGROUND

Diversity in medicine is an academic imperative. Incorporating diversity offers many benefits to the community, within and outside the walls of the emergency department (ED).[1–3] Diversity creates richer educational experiences, amplifies cultural competencies, and strengthens professionalism.[1,4,5] A diverse physician group also improves patient care and outcomes,[2,6] as physicians underrepresented in medicine (UIM)*[1] enhance cultural sensitivity and are more likely to serve low-income, minority, and disadvantaged populations.[2,4,7]

Despite the increased recognition and efforts, only a small number of medical specialties have demonstrated statistically significant increases in representation, suggesting that current efforts are insufficient.[8] When the 20 largest specialties in medicine were analyzed between 2007 to 2018, none represented Black or LatinX populations in proportions comparable to the overall United States (US) population.[8] One study found that Black and LatinX representation was still sparse at the medical school faculty level (7.5%), despite 14.1% representation among medical students and 30% at the US population level.[8] Within emergency medicine (EM), women account for only 25% of physicians, while Black, LatinX, and Native American physicians comprise less than 10% of all active emergency physicians.[9] Furthermore, a

[1]*The Association of American Medical Colleges (AAMC) defined the term underrepresented minority (URM) to reflect the racial groups of Black, Mexican American, mainland Puerto Rican, and Native American (American Indian and natives of Alaska and Hawaii). In 2003, to encompass the racial and ethnic populations within medicine who are underrepresented when compared to their respective numbers in the context of the greater population, this was further clarified to "underrepresented in medicine"(URiM or UIM). Although we recognize the use of URiM or UIM interchangeably, for consistency, we will use the term UIM throughout this paper.

recent study projects that EM will take about 54 years to reach the level of LatinX faculty representation commensurate with that of the US population.[8]

Pipeline and pathway programs (PP)[1*2] increase opportunities for UIM candidates through outreach, mentorship, and other critical structural support needed to advance diversity, equity, and inclusion (DEI) in medicine. In this paper, we delineate pipeline, pathway, and outreach, mentorship, and other critical structural support needed to advance diversity, equity, and inclusion (DEI) in medicine. In this paper, we delineate pipeline, pathway, and outreach programs, discuss components of PPs, and steps toward successful implementation of DEI initiatives.

CRITICAL APPRAISAL OF THE LITERATURE

The Council of Residency Directors in Emergency Medicine (CORD) Best Practices Subcommittee publishes a series of articles entitled CORD Best Practice reviews; this manuscript is ninth in the series.[10-17] With the assistance of a medical librarian, we conducted a literature review from inception until January 2021 through MEDLINE via PubMed using the terms and Medical Subject Headings focused on DEI (Appendix). Additionally, a bibliography review was conducted for additional articles. Two reviewers independently screened the 2080 articles, finding 58 relevant for this review.

We created best practice recommendations based on the literature appraisal. Whenever supporting evidence was unavailable, consensus opinion and the authors' combined expertise were used. The Oxford Centre for Evidence-Based Medicine criteria (Tables 1 and 2)[18] were implemented to provide the level and grade of evidence for each best practice statement. Prior to submission, the manuscript was reviewed by the CORD Best Practices Subcommittee, followed by a two-week review on the CORD website for feedback from the CORD community.

Table 1. Oxford Centre for Evidence-Based Medicine levels of evidence.[17]

Level of evidence	Definition
1a	Systematic review of homogenous RCTs
1b	Individual RCT
2a	Systematic review of homogenous cohort studies
2b	Individual cohort study or a low-quality RCT*
3a	Systematic review of homogenous case-control studies
3b	Individual case-control study**
4	Case series/Qualitative studies or low-quality cohort or case-control study***
5	Expert/consensus opinion

*defined as <80% follow up; **includes survey studies and cross-sectional studies; ***defined as studies without clearly defined study groups.
RCT, randomized control trial.

Table 2. Oxford Centre for Evidence-Based Medicine grades of recommendation.[17]

Grade of evidence	Definition
A	Consistent level 1 studies
B	Consistent level 2 or 3 studies or extrapolations* from level 1 studies
C	Level 4 studies or extrapolations* from level 2 or 3 studies
D	Level 5 evidence or troublingly inconsistent or inconclusive studies of any level

*"Extrapolations" refer to data used in a situation that has potentially clinically important differences from the original study situation.

Barriers to Entering the Health Professions

Barriers exist that hinder students from entering the health professions. Recognition of the barriers (Table 3) for UIM, female, and economically disadvantaged students provides perspective on the challenges that must be overcome to pursue a career in medicine.[19-25] This further highlights the importance of pathway programs to ensure a diverse, equitable and inclusive medical workforce.

Simply recognizing these barriers is not enough. Deliberate actions to mitigate or remove these barriers is imperative, including creation of novel educational and training frameworks that focus on improving trainee performance.[5,26-27] Pathway programs create a supportive network and inclusive culture[26] to reduce the isolation experienced by UIM. The greatest barrier to successful entry into health professions for UIM students is the undergraduate-graduate interface, due to the high attrition rate, with only 38.1% of all UIM doctoral candidates completing their degrees, as opposed to 51.3% of all non-UIM doctorates.[26]

Overview of Pipelines, Pathways, and Outreach Programs

A scoping literature review found the most frequent approaches to increase minority representation in the

[2]*The words pipeline and pathway carry with them different perspectives. Pipeline can be considered restrictive, exclusive, and confining and may have potentially harmful attributions, such as the "school-to-prison" pipeline.[10] Pathways, in contrast, acknowledges a compendium of entry points that support the program. Because of this, some advocate for the move away from the word pipeline to favor the use of pathway,[10] and thus pathway will be used throughout the remainder of this article.

Table 3. Barriers to health professions education for students underrepresented in medicine.[13,18-23]

Socioeconomic barriers	• High indebtedness • Lack of encouragement to complete high school, enter college, or pursue higher education • Lack of financing for college and graduate school • Low income/poverty • Need to provide financially for family • Teen pregnancy/Early parenting
Educational barriers	• Concerns regarding duration of training • High dropout rates of UIM in high school and college • Hidden curriculum propagating bias/racism • Less developed networks and lack of mentorship • Lack of minority faculty • Lack of traditional educational path • Low on-time graduation rates • Poor performance on standardized achievement tests
Psychosocial barriers	• Difficulties in acclimation to majority culture • A sense of isolation due to low visibility of others with similar backgrounds • Lack of support from family and friends • Lack of cultural representation • Stereotype threat/risk of person conforming to stereotypes about their social group • Undesirable geographic distance of school from student's home and community • Low expectations of academic ability by others

UIM, underrepresented in medicine.

medical workforce were PPs (43%), changes in affirmative action laws (23%), and changes in admission policies (21%).[5] Pipeline/pathway terminologies are often used interchangeably to describe programs created to increase minority matriculation into medical schools and healthcare workforce diversity. Starting as early as elementary school, these programs offer mentorship to UIM students,[28] offering opportunities to identify and support future diverse medical students.[5,28,29] Outreach programs are typically discrete events, consisting of a single or a select number of time points (Table 4).[3,28,29] They may include second-look visits or weekends for UIM applying to medical schools, often run by the school's diversity committees or Student National Medical Association groups.[3]

Pathway programs effectively enhance academic performance and increase the likelihood that UIM and other disadvantaged undergraduate students enroll in a health professions school. However, the long-term success when targeting high school students remains <20%, suggesting that work still needs to be done to bridge this gap.[28]

Table 4. Outreach activities for students underrepresented in medicine.[28,29]

- Workshop on getting admitted to medical school
- MCAT guidance
- Workshop on writing a personal statement
- Education on financing medical school
- Mock interviews
- Shadowing opportunities such as "Day in the Life of a Medical Student."
- Sample lectures, labs, and small-group discussions
- Second look visits or weekends for UIM applying to medical schools

MCAT, Medical College Admission Test; *UIM,* underrepresented in medicine.

TYPES OF PATHWAY PROGRAMS

Pathway programs are a key strategy for increasing the enrollment of UIM students into medical schools.[28] These programs, described below, are created to target different age groups of learners, to provide a variety of educational or developmental benefits,[28] and to encompass different goals.

Elementary/High School-to-College Program Pathways

Elementary and high school programs help pre-college UIM students succeed through their primary and secondary education, to continue progressing down the pathway toward medical school. Early introduction and exposure to healthcare has been shown to effectively influence career decisions.[32] Studies have found that among all ethnic groups, the major hurdles to attending medical school are obtaining a high school diploma and bachelor's degree.[33] Once this hurdle is overcome, the proportion of UIM college graduates to apply to medical school are similar to proportions of White college graduates.[33]

Goals of these programs include preparing students for college life,[27,34] exploring different healthcare careers,[27,35-37] increasing research exposure,[38-39] and improving basic science knowledge.[2] Programs vary from summer experiences [2,37,40] to longitudinal experiences during the school year[19] and offer educational components, such as core sciences (eg, biology, chemistry)[2] or healthcare-related topics (eg, disparities, physiology, patient interview sessions).[19,27,32,41,42] Interactive sessions such as simulation, physical exam practice, workshops, and seminars are also included.[19,31,32,36,41,43]

College preparation is a significant component of many elementary-to-high-school PPs, and include exposure and guidance to the university admissions process,[2,19,41] financial aid guidance,[2,19,41] and college fairs.[43] Because standardized test scores continue to be a barrier for UIM, Scholastic Assessment Test preparation is also a frequent element of these programs.[2,39,44]

Mentorship is a crucial component of elementary-to-high-school PPs and may be provided by medical students, graduate students, or working professionals.[2,29,37,41,45] Shadowing opportunities are important,[2,35] including patient care in free clinics.[42] Multiple studies suggest that educational content and

mentorship can be provided by medical students.[32,46] Another strategy was the creation of Health Professions Affinity Clubs, in which volunteers visited high schools to introduce students to health professions via projects, mentoring, and shadowing opportunities.[29]

College-to-Medical-School Pathway

Undergraduate level pathways serve to expose UIM students to the health professions. The structure of these programs vary in length,[30,31] frequency of meetings,[47] time of year,[39] and depth of contact.[47] Another common PP is summer internship programs offering opportunities in education,[27] research,[39,47] clinical care,[48] or a combination of these (Table 5).[48-51]

Table 5. Examples of undergraduate pathway programs.

Name	
Summer Medical/ Dental Education Program[2,24]	• National summer enrichment program for college undergraduates from disadvantaged backgrounds that provides intensive preparation for medical or dental school.[2,25] • Provides courses in science, math, writing, and career development skills based on an individualized education plan.[25] • Medical school acceptance rate of 64% among undergraduate participants.[2]
Health Frontiers in Tijuana Undergraduate Internship Program[41]	• 14 consecutive. weekly, one-hour clinical shadowing engagements. • Integrates US undergraduate students longitudinally in a US-Mexico binational free clinic alongside their Mexican undergraduate peers. • Exposes undergraduate interns to clinicians with different health careers based on student's area of interest or at the medical student-run free clinic. • Incorporates education on medical Spanish, conditions seen frequently in clinics, and barriers to healthcare.[41]
SEALS[42]	• Six-week program that promotes socialization, education in science learning, acquisition of financial literacy, leveraging of mentorship and networks, and resilience • Sessions use lectures, dissection lab, clinical shadowing, workshops on writing skills, and workshops on professional development.[42]
Health Disparities Clinical Summer Research Fellowship Program[47]	• Incorporates healthcare exposure with research. • Community organization that involves shadowing healthcare professionals, engaging in enrichment activities, and providing information on health-professions graduate school admissions, as well as preparing for the MCAT.

US, United States; *MCAT,* Medical College Admissions Test.

Longitudinal pathways exist to offer "living and learning communities," consisting of a designated dorm floor for pre-health students to enhance networking and surround undergraduate students with a supportive cohort.[47] Undergraduate pre-health organizations also provide career counseling, test support, networking opportunities with health professions students and faculty, and shadowing opportunities.[47]

Bachelor of Science-Medical Doctor (BS-MD) Pathway

The combined BS-MD program can be a high school or undergraduate school to medical school pathway. For example, the Premedical Honors College, an eight-year college-to-medical-school program targeting South Texas medically underserved counties,[52] of which the majority of the population (81%) identifies as LatinX. It provides conditional acceptance to medical school based on the completion of the bachelor of science and includes rigorous undergraduate curriculum, enrichment experiences, clinical experiences, tutoring, and a summer research program.[52] It has successfully produced 134 medical school matriculations, 110 (82%) of which are UIM and 106 (79%) are LatinX.[53]

Other BS-MD programs offer undergraduates conditional acceptance to medical school. The Mount Sinai School of Medicine created a Humanities and Medicine program, an early admissions program that allows sophomore-year undergraduate students to apply and pursue their interests in humanities and social sciences prior to matriculating to medical school.[39] These programs often do not require Medical College Admission Test (MCAT) scores and thus remove one barrier to gain acceptance to medical school.[54]

Community Colleges (CC) to Medical School

Another undergraduate-to-medical-school route is the community college (CC) pathway. Defined as two-year post-secondary education institutions, CCs serve as a common pathway to the attainment of higher education for low-income and UIM students. Talamantes studied medical students' educational path to better understand the use of CCs,[54] and found that of students using a CC pathway, LatinX were the most common racial-ethnic group (34%), followed by Black (28%), White (27%), and Asian (27%) matriculants.[54] This data suggests that PPs targeting CCs may be a promising approach to increasing the diversity of medical students. An improved process to transfer credits from CCs to four-year institutions is recommended.[55]

Post-Baccalaureate Pathway Programs

Post-baccalaureate pathway programs (PBPP) are an important strategy for increasing diversity among medical school matriculants. The UIM and disadvantaged students tend to be at greater risk for academic difficulties and lower MCAT scores, which are known barriers to medical school admission.[35,56] The PBPPs frequently involve a

one- or two-year curriculum[38,56,57] that emphasizes basic science skills required for the MCAT and medical school. Other topics include academic enrichment skills, personal well-being, and professionalism.[31,35,38,57-59] Some PBPPs may offer research options,[35,38,39] while others focus on clinical opportunities with underserved patients.[51] These PBPPs consist of small cohorts (2-8 students) and are often supported through institutional funding to provide financial support and tuition waivers.[31,38]

In 2014, 36% of national PBPPs identified themselves as having a special focus on UIM or economically or educationally disadvantaged students.[58] Many programs offer early or conditional acceptance to degree-confirming MD, PhD, and combined MD/PhD programs, pending successful completion of the program.[2,31,35,39,51,52,58] A few PBPPs confer master's degrees or certificates upon successful completion.[2,51,56] Academic or civic credit may also be awarded to students for participating.[34,48] Students are selected via a national open application,[38] with preference often given to those who had been unsuccessful in their medical school applications.[31,51]

Despite having academic profiles that were not promising for medical school admissions on entering the Medical/Dental Education Preparatory Program (MEDPREP) program, 83.3% of graduates successfully matriculated in medical school.[56] Of those, 53% worked in primary care and 40% worked in medically underserved areas after graduation.[56] Long-term data has shown that PBPP graduates have pursued careers in every specialty and are more likely to provide care in underserved areas or for vulnerable populations.[28]

Historically Black Colleges and Universities

Historically black colleges and universities (HBCU) and historically black medical schools (HBMS) have a significant impact on the diversity of medicine.[61,62] The HBMSs are instrumental in the overall representation of Black chairs, faculty, and students in US medical schools.[62] Xavier University and Howard University are the top two producers of Black graduates of medical schools.[63] Black students who graduate from HBCUs were found to be more likely to go to graduate school and complete their doctoral degrees than Black students from other schools.[61]

The HBCUs were found to devote greater effort to premedical training, developing strong relationships with medical schools and offering a range of sponsored enrichment opportunities to their students.[63] Successful interventions include providing all premedical students a core curriculum instead of allowing them to choose their courses, providing tutors for all first- and second-year students, and beginning MCAT practice during their first year of college.[61] The HBCUs are also successful in building strong pathway partnerships with medical schools, educating on health disparities, and teaching cultural competency skills.[61] Best practice recommendations are summarized in Box 1.

Box 2. Best Practice Recommendations

- **Interventions should be focused on helping to overcome the major hurdles to medical school entrance for UIM (e.g., high school diploma and a bachelor's degree). (Level 5, Grade D)**
- **Develop and support PPs to create opportunities for the introduction and exposure to healthcare at an early time point in order to influence career decisions in UIM. (Level 4, Grade C)**
- **Allow medical students to deliver educational content and mentorship for PPs and outreach programs.(Level 5, Grade D)**
- **Consider PPs targeting community colleges as an approach to increasing the diversity of medical school applicants, most notably Latinx UIM. (Level 5, Grade D)**
- **Consider post-baccalaureate premedical programs with a focus on UIM or disadvantaged students as an important strategy to increasing diversity in medical school matriculants. (Level 5, Grade D)**
- **Collaboration with HBCUs is beneficial, as HBCUs graduate students that are more likely to attend and complete graduate school. (Level 5, Grade D)**

UIM, Underrepresented in Medicine; *PP*, Pathway programs; *HBCU,* Historically Black Colleges and Universities

INFRASTRUCTURE AND FRAMEWORKS FOR IMPLEMENTING PATHWAY PROGRAMS

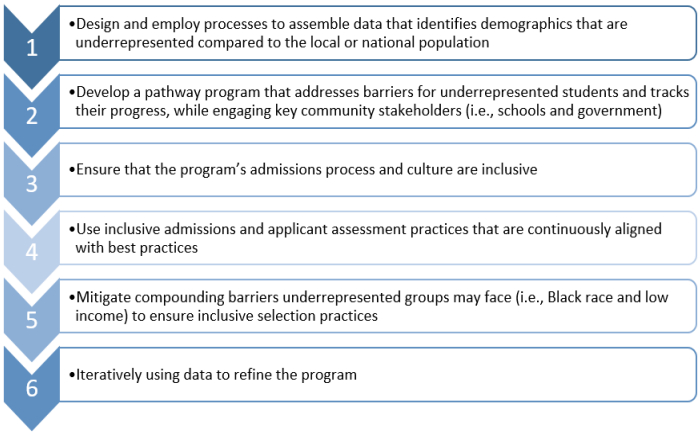
Factors related to implementing PPs are important determinants of the success of these programs. Below, we explore the following implementation elements: frameworks and theories; funding; participant selection; academic enrichment and instructional design; and mentoring, advising, and networking.

Frameworks and Theories

Several articles outlined PPs' frameworks and theoretical underpinnings. Young built on the knowledge translation framework to generate a six-part framework for developing PPs (Figure 1).[64] When developing a portfolio of comprehensive PPs across the educational continuum, Grumbach suggested that institutions adopt a "distal-to-proximal" strategy to prioritize later-stage participant support (eg, post-baccalaureate programs) and then work backwards to include earlier stage programs.[65]

Johnson and Bozeman constructed the asset bundles model from other models and theories that focus on human capital (eg, knowledge and technical abilities), social capital (eg, ability to tap into resources embedded in relationships), and the ways in which institutions perpetuate marginalization.[25] Asset bundles are "the specific sets of abilities and resources that individuals develop that help them succeed in educational and professional tasks."[25] The authors assert that these five asset bundles are critical to retaining UIMs on successful educational pathways (Table 6).[25] Many PPs incorporate individual assets, but few programs work to enhance all the assets.[25,49]

Figure 1. Young and colleagues' framework for diversity-related pathway programs.



Funding

Sustainable funding is critical for the success and survival of PPs. Programs are usually funded from multiple sources, including federal, foundation, and institutional investments.[27,29,31,34,37,38,41,44,48,50,57] Less commonly, programs received funding from non-profit professional organizations, private entities, and state legislative appropriations,[36,38,41,44,47,57] or program alumni efforts.[57] Federal funding for PPs has been dramatically reduced over the years.[65] In drafting this manuscript, we searched for several of the federal funding sources for cited programs, which currently are not taking new applications. As external funding for PPs shrink, greater onus is on universities and health systems to fund these initiatives.

The program budgets ranged widely from $2,600 (2007 dollars) for a student-run, specialty-specific initiative, to $25,000 (2018 dollars) for a two-day workshop, to several million dollars for a comprehensive collection of PPs.[30,34,47,49,65] The University of Illinois at Chicago's Urban Health Program is funded by the state and seven university colleges to amass an approximately $4.3 million budget (2012 dollars) that serves hundreds of preschool through graduate school students annually.[47] The state's financial contribution was tied to metrics that demonstrated success in supporting UIM students matriculation to the health professions. In 2011, highly effective PBPPs typically cost $20,000.[65] Those aimed at UIM scholars tended to discount fees for students and rely mostly on institutional sources of funding.[52] Some programs offered students stipends, scholarships, and/or wages to cover the costs of travel, tuition, fees, attendance at conferences and workshops, and other financial needs.[2,19,27,31,38,40,49,52,58]

Participant Selection

Most PPs aim to support and facilitate educational and healthcare career advancement for UIM racial and ethnic gr oups.[19,27,30,31,35,38,41,47-50,52,56-58,60,66,67] Few programs share their participant selection criteria in detail and rarely state race/ethnicity criteria.[30] Commonly, programs used proxy criteria

Table 6. Asset-bundle model components and descriptors.

Asset bundle	Description
Human Capital: Educational Endowments	• Focuses on academic performance, which is primarily determined by students' high school math and science curricula and teacher quality. • Advance courses such as advanced placement, international baccalaureate, and college prep, as well as hands-on laboratory experiences, study groups, tutors, and systemic educational reform to improve math and science curricula can enhance this asset.
Human Capital: Science Socialization	• UIM students may need additional encouragement to envision themselves as physicians and scientists, as it is unlikely that they have regular access to role models in these fields in their homes or proximal communities due to systemic underrepresentation. • This can be done by 1) emphasizing the relevance of science and technology to addressing problems in their community; 2) exposing students to successful identity-concordant scientists and physicians; and 3) developing individualized plans to benchmark students' progress toward their career goals.
Social Capital: Network Development and Expansion	• Mentoring and extracurricular activities are important avenues to develop and expand social networks. • Mentoring that is both identity-concordant and cross-cultural can be successful in expanding students' networks and facilitating positive career outcomes. • Broadening peer networks through multiracial study groups, for instance, may expose UIM students to information and resources they would not otherwise obtain.
Social Capital: Family Expectations	• Family expectations, which may be dictated by constraining social norms such as women in caretaking roles, may create tension with educational goals. Conversely, familial expectations that affirm educational goals can be a positive influence. • These dynamics are difficult to impact externally; thus, programs may need to reinforce other assets such as science socialization.
Financial Capital: Material Resources	• Scholarships and grants are critical resources needed to reduce education attrition among students who do not have significant familial financial resources. • Economically disadvantaged students often take part-time employment, limiting their time for academic study and extracurricular enrichment, which further limits their competitiveness for scholarships.

UIM, underrepresented in medicine.

for race/ethnicity including being from educationally/economically disadvantaged backgrounds.[27,30,31,35,38,47,48,66] To attract UIM students, some PPs recruited from majority UIM schools and communities, focused on racial/ethnic health inequities, or selected students whose attributes and interests reflected the institution's mission.[27,31,34-36,38,39,41,44,48-50,52,58]

Few programs stated they used holistic review to select participants.[31,41,47,58] Traditional measures of academic success (ie, grades and test scores) were only occasionally included as selection criteria.[2,19,36,38,40,49,50,52,56,67] One program only used academic measures to exclude candidates with extremely low scores,[48] while another program intentionally sought candidates whose academic performance may not have matched their potential.[38] Nevertheless, satisfactory test scores and grades were used as measures of successful completion of the program.[31,35,52,58]

While most programs included interest in medical or science careers in their selection,[2,19,27,30,35,44-46,50] one program specifically excluded students who had previously shadowed physicians or participated in medical-related community service in order to capture students who needed an initial exposure to medicine.[42] Most programs only required written application materials, but the MEDPREP program also required on-site reading comprehension testing and two faculty interviews.[56] The MERIT program invited students to a three-week "tryout" medical leadership course, evaluating students based on peer interactions, homework, and punctuality as indicators of their passion and potential, as opposed to traditional academic measures.[41] Note that this program made a significant and longitudinal investment in their participants for seven years, prompting their intensive screening process. A detailed target population resource based on target population, selection criteria, and application components can be seen in the Appendix.

Academic Enrichment and Instructional Design

The central feature of PPs are educational support and skills development. Many provided math and science enrichment and test prep through locally developed programs or professionally delivered courses[2,27,30,31,38,39,41,44,47,52,56-59,69] with several programs developing individualized focused educational plans.[25,27,30,35,38,57,58] Other academic enrichment activities include one-on-one and group tutoring, study skills, critical thinking, leadership skills, public speaking, and writing.[2,27,31,38,39,47,49,52,56-59,66-68] A few programs taught professionalism skills such as punctuality, email writing, goal-setting, "appearance," "etiquette," and "speaking and dressing appropriately."[40,41,58] Some programs hosted wellness sessions and stress reduction techniques to mitigate burnout.[27,41]

Academic enrichment was provided in both didactic and experiential formats, using large- and small-group formats and employing multiple educational approaches (Table 7). Clinical shadowing opportunities with faculty and resident physicians were included in many programs.[2,31,35,36,41,42,47,49-52] These shadowing opportunities often progressed to shadowing with history-taking and ended with independent history-taking and oral presentations.[51]

Table 7. Structured learning approaches for pathway programs.[2,11,13–16,25,28,29,31–35,38,41–44,50,56–58,60]

Lectures and seminars
Readings
Videos
Clinical vignettes
Problem-based learning
Hands-on dialectics
Inquiry-based lab experiments
Simulation training
Facilitated review
Role-playing
Skits
Debates on medical ethics
Games
Props and models
Interviewing standardized patients
Personal narratives
Written reflections
Humor

Mentoring, Advising, and Networking

Mentorship helps to transform students' thinking, enhance knowledge, develop technical skills, broaden aspirations and confidence in a future scientific career, and improve "professional socialization."[68] Although the characteristics students valued in a mentor varied based on the students' demographics, all agreed that engaged mentors were the most effective. The importance of concordant mentors (racial/ethnic, gender, and sexuality) was also underscored in several studies, citing the intangible benefit of having a mentor that "looks like you" in helping students visualize themselves as successful physicians.[26,27,38,69,70] Having a concordant mentor may minimize beliefs that their aspirations are unattainable and mitigate experiences of isolation that are linked to low self-efficacy.[25,26,39,31,70]

Mentorship may be structured, small group-led faculty or one-on-one mentoring.[27,30,31,34-36,38,41,49,56,66] Rarely, mentoring and coaching was longitudinal, including after participants complete the program and during major transitions (eg, from high school to university).[37,38,41,49] Peer and near-peer mentoring and advising was also a component of some programs.[36,38,45,47-50,53,56,68.72]

In addition to formal mentoring, PPs also facilitate networking opportunities in small groups for students to interact with physicians, scientists, medical graduate students, and alumni.[30,31,36,38-41,43,47,50,66] Often, formal networking occurs over scheduled lunches. Informal networking occurred during events like career fairs, didactics, research symposium, shadowing, and barbecues. Several programs also offered mental health counseling and other intensive

social and emotional support to their participants.[2,27,38,47,56-58] Several programs provided general career advising, covered college and medical school admissions, coached students on interview preparation, and counseled on financial planning and scholarships.[2,19,20,30,31,34,38,41,46,47,49,50,56,66,68,71] Best practice recommendations are summarized in Box 2.

Box 2. Best Practice Recommendations

1. **PPs should use frameworks and theories that leverage participants' assets, incorporate diverse and developmentally appropriate learning techniques, maximize relevance local health concerns, and center participants' identities and lived experiences in an affirming way. (Level 5, Grade D)**
2. **PPs should develop robust, intra- and interinstitutional partnerships to ensure success. (Level 4, Grade C)**
3. **Federal, foundation, institutional, and private funding is critical and should be sought out and advocated for. (Level 4, Grade C)**
4. **When creating a program to support UIM groups, clearly state selection criteria including, but not limited to, UIM race/ethnicity selection criteria, along with other primary selection criteria (eg, factors associated with systemic disadvantage, interest in healthcare, markers of academic success). (Level 4, Grade C)**
5. **Create programs for academic enrichment that utilize a variety of approaches and instructions for both didactic and experiential learning. (Level 4, Grade C)**
6. **Programs should consider identity-concordant mentoring, coaching, and networking as they are powerful mechanisms to encourage and motivate UIM success. (Level 4, Grade C)**

UIM, Underrepresented in Medicine; *PP*, Pathway programs

LIMITATIONS

This paper focused on pipeline, pathway, and outreach programs. Recognizing the vastness of DEI, other topics (eg. faculty recruitment and retention, holistic review, mitigating bias in residency recruitment) will be covered elsewhere. It is possible that we may have missed some relevant articles in our search. To mitigate this, a comprehensive search strategy with the aid of a medical librarian was conducted, supplemented by bibliographic review and additional recommendations from topic experts. Much of the research on DEI is observational, and multicenter RCTs are often lacking. Our findings may represent associations as opposed to causation given the nature of the research available. Finally, much of the literature of pathways focuses on general fields in health professions education; there is limited literature specifically focused on pathways within EM.

CONCLUSION

Pathway programs are critical to increasing diversity within medical schools. Increasing diversity in medical schools is critical to increasing diversity in EM and other specialties. This paper summarizes components of PPs and steps toward successful implementation through best practice recommendations. We hope this manuscript will inform readers on how best to form and sustain new PPs at their institutions.

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Virtual Town Hall Meetings to Convey Emergency Medicine Residency Program Information to Students

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Background: Applying to emergency medicine (EM) residency programs as a medical student is challenging and complicated in a normal year, but the 2020/2021 application cycle was further complicated by the COVID-19 pandemic. Due to the decrease of in-person opportunities for students to connect with residency programs, virtual "town-hall" meetings were developed. In this study our primary objective was to determine whether attendance at a virtual residency program information session improved the perceived knowledge of curriculum information and program exposure to medical students applying to an EM residency.

Methods: Four study sites hosted a total of 12 virtual events consisting of residents, faculty, or both. Standardized pre-event/post-event surveys were conducted to capture medical student perceptions before/after each of the virtual sessions. Apart from measuring the improvement in students' perceived knowledge of a program by gauging their responses to each question, we used a 10-question composite score to compare pre- vs post-event improvement among the participants.

Results: The pre-event survey was completed by 195 attendees, and the post-event survey was completed by 123 attendees. The median and mean composite score to this 10-question survey improved from 32.19 to 45, and 31.45 to 44.2, respectively, in the pre- to post-event survey.

Conclusion: This study showed improvement of medical students' perceived knowledge of residency programs (reflected as increased agreement from pre- to post-event survey). The data demonstrates through question responses that students not only obtained information about the programs but also were able to gain exposure to the culture and "feel" of a program. In a non-traditional application season in which students are unable to pursue their interest in a program through audition rotations, virtual town hall events, along with other asynchronous events, may be a reasonable approach to increasing medical student understanding and awareness of a program and its culture. [West J Emerg Med. 2022;23(4)525–531.]

INTRODUCTION

Applying to residency is a challenging annual endeavor for medical students who are forced to make decisions about where they would like to train when they may have a limited amount of information about programs. They rely on residency websites, social media, personal communication, online forums, and in emergency medicine (EM) in particular, audition rotations and in-person visits.[1] These opportunities serve both as a pre-interview experience for the prospective student and as a place for information exchange. Students discuss and experience culture, residents, attending physicians, patient populations, support staff, and the physical location of the programs. Programs attempt to identify whether the student is a fit with the culture and gauge their ability to learn and grow, as well as their baseline medical knowledge. It has been shown that some of the most important factors in student selection of a program include how happy the residents seem, faculty-resident relationships, how well the residents work together, values of residents and faculty, and whether the residents spend time together outside of the residency and there are shared interests.[2] These are traits difficult to communicate without in-person experiences.

During the 2020-2021 application cycle, amidst the coronavirus 2019 (COVID-19) global pandemic, most of the opportunities that previously took place in person were not feasible. There was significant concern that many third-year medical students would not be able to gain clinical and program-specific experience before submitting their residency applications.[3] Fewer and shorter clinical rotations were available for interested students because host institutions were attempting to limit COVID-19 exposure. COVID-19 also led to the creation of the "Consensus Statement on the 2020-2021 Residency Application Process for US Medical Students Planning Careers in Emergency Medicine in the Main Residency Match" by 10 medical education organizations, limiting each student to one EM rotation, typically at their home institution.[4] Both residency programs and medical students worked to develop creative ideas to showcase their strengths and connect with each other through innovative methods not previously used. Students were attempting to gather information and evaluate programs while residency programs were working to identify alternative ways to share more than the facts and figures that websites typically offer.

One novel method emerged for students and residents to share information through virtual "meet and greet" events, sometimes referred to as "town hall events," "get to know us sessions," or "virtual tours." These virtual events, hosted by the residency program, became a popular way to connect programs and students. The basic format was a series of sessions, or a single video session, hosted and promoted by a specific residency program, led by either current residents, faculty, or both. A brief presentation or introduction was typically provided, followed by a space for students to ask questions and glean information about specific program details. Some programs offered multiple sessions, each highlighting specific strengths.

Population Health Research Capsule

What do we already know about this issue?
Residencies use virtual "meet and greet" events to connect programs and students, but the effectiveness of these events has not been studied.

What was the research question?
Do virtual information sessions improve medical student knowledge of curriculum offerings and provide enough program exposure?

What was the major finding of the study?
Attendance at virtual information sessions improves the perceived knowledge of curriculum and enhances program exposure.

How does this improve population health?
Residency programs should consider incorporating these types of events to enhance medical student recruitment and convey important program information.

After performing a brief search through social media outlets, program websites, and virtual newsletters from EM professional organizations, we found that as of August 2020 at least 99 of 273 EM residency programs publicized or participated in a virtual event. This number significantly increased by the end of the 2020-2021 application cycle with 224 EM residency programs participating in a virtual event as of March 2021. These events ranged from Instagram or Facebook live events to Zoom gatherings and panels. Prior to this application cycle, such events were uncommon and did not appear to be a standard way of disseminating information to the residency applicant pool. Thus, there was no published research to date on the effectiveness of a live virtual recruitment event in providing useful information to EM applicants attempting to make residency selection decisions. With many EM residency programs transitioning to these virtual events for recruitment purposes, we believed it would be important to determine whether a virtual format is an effective method of improving applicant understanding of curriculum information and enhancing program exposure.

In this study our primary objective was to evaluate the usefulness of this kind of event at four different residencies

within the US using pre- and post-event surveys. Specifically, does attendance at a virtual residency program information session improve the perceived knowledge of curriculum information and program exposure to medical students applying to an EM residency? We hypothesized that participation would allow for increased self-reported knowledge of various specific program details and increase the interest of the applicants in the program.

METHODS

This was a multicenter pre- and post-intervention survey of medical students attending a virtual residency information session at one of the four study sites. Site one is a three-year county hospital-based EM program with 45 residents in Arizona, which hosted one session. Site two is a community-based four-year EM program in Oklahoma with 30 residents, which hosted two sessions. Site three is a three-year county hospital-based EM program with 45 residents in Texas that hosted eight sessions. Finally, site four is a three-year community rural ED with 36 residents in New Jersey that hosted one session.

Each site was responsible for promoting its own event including advertising, date selection, time, virtual software platform used, and number of dates to offer their meetings. A standardized pre- and post-event survey was used by all four sites with voluntary participation by the students who attended each event. We provided each program with a survey template using Google Forms (Google LLC. Mountain View, CA), which each program could then individually brand without changing the content of the survey. Students were recruited before and after the session to fill out the survey information.

As the use of virtual information sessions is a relatively novel practice, there are no previously validated surveys on this topic. Students were instructed to indicate their agreement using a Likert scale with specific statements before and after the sessions. Questions were developed, reviewed, piloted, and refined by the research team and adapted from previously published literature indicating some of the top reasons medical students select a residency program.[2,5] Written consent was obtained prior to completion of the surveys by all subjects. We also collected demographic information was also collected including age, gender, medical school year of training, and geographic location. To ensure blinding and total anonymity, the last five digits of the participants' phone numbers were used to link the pre- and post-event surveys. It was imperative to make it clear to the participants that the survey was both voluntary and anonymous to prevent concern about possible attribution or effect on their residency application. The project received a human subjects' research exemption from the Valleywise Health Institutional Review Board and was completed in 2020.

Summary of all the respondents and questions were described along with comparison of pre-post matched responses linked using the last five digits of the respondents' phone numbers. For each question, the highest level of agreement was assigned a score of 5 with the lowest level of agreement assigned as 1. We used the Wilcoxon signed-rank test to compare the score for each question by students who responded to both pre- and post-surveys. Responses were further dichotomized into "agree or strongly agree" vs all other responses; we used McNemar two-sided tests to evaluate changes in agreement pre- and post-surveys. For 10 questions, perfect favorable agreement would make a total agreement score of 50, which was used as a composite score to evaluate overall pre-post change in level of agreement. We used the Wilcoxon signed-rank test to compare differences in composite scores pre- and post-survey.

RESULTS

Overall, the pre-survey was completed by 195 attendees, and the post-event survey was completed by 123 attendees. Response proportions for pre-surveys ranged from 40.23% to 59.02% of total attendance across four locations, which were slightly higher than 21.88–49.18% for the post-event surveys (Table 1). Survey response and demographic information is displayed in Table 2, including a breakdown of which location session the participants attended. Distribution of those participants who chose to report gender was nearly evenly split between male and female. Many of the participants were between the ages of 26-30, and most were fourth-year medical students. Geographically, all areas of the country were represented with the largest number from the southwest United States and the lowest percentage of participants from the northwest or international.

Table 1. Response proportions to surveys administered before and after virtual information sessions across the four study locations.

		Count of respondents* (Response percentage)	
Location	Attendance	Pre-survey	Post-survey
Site 1	151	69 (45.7)	41 (27.15)
Site 2	87	35 (40.23)	31 (35.63)
Site 3	61	36 (59.02)	30 (49.18)
Site 4	96	51 (53.13)	21 (21.88)
Overall	395	191 (48.35)	123 (31.14)

*Actual count of responses for each question may be less than the total due to non-response to that question.

Table 3 illustrates pre- and post-event survey summaries. Values ranged from 1 to 5 with 1 representing strongly disagree, and 5 representing strongly agree. The median and

Table 2. Respondent demographics.

	Count	Percentage
Gender		
Male	72	36.92
Female	65	33.33
Missing	58	29.74
Age range		
26-30	113	57.95
20-25	39	20.00
31-35	32	16.41
36-40	6	3.08
41-45	1	0.51
Missing	4	2.05
Year of training		
MS4	150	76.92
MS3	21	10.77
MS2	8	4.10
MS1	7	3.59
Graduate	4	2.05
Missing	5	2.56
Geographic location		
Southwest USA	55	28.21
Northeast USA	48	24.62
Southeast USA	38	19.49
Central USA	34	17.44
Northwest USA	11	5.64
International	5	2.56
All other values	4	2.05
Completed pre-surveys		
Site 1	69	35.38
Site 2	35	17.95
Site 3	36	18.46
Site 4	51	26.15
Missing	4	2.05
Completed post-surveys		
Site 1	41	33.33
Site 2	21	17.07
Site 3	30	24.39
Site 4	31	25.20

MS, medical student; *USA,* United States of America.

mean composite score to this 10-question survey improved from 32.19 to 45, and 31.45 and 44.2, respectively, in the pre- to post-event surveys. Of the total number of completed surveys 75 attendees from three institutions were matched as completing both the pre- and post-event surveys (35 from site one, 24 from site two, and 16 from site three). Unfortunately, at site four, no participants could be matched to link the pre- and post-event surveys.

We further analyzed these 75 participant responses to determine efficacy of the goals of the information sessions. Table 4 shows overall data results for these 75 matched responses, as well as location-specific results. All questions showed improvement from pre- to post-event surveys following the information sessions. Table 5 displays the matched pre- and post-event question results and demonstrates a change from before and after the virtual information session. For statistical analysis, "neutral," "disagree," and "strongly disagree" (1, 2 and 3) were clustered as a disagreement. Similarly, "agree," and "strongly agree," were clustered as an agreement to improve overall data analysis. Of note, 15 responses were missing from question one due to site four inadvertently editing their version of the survey, removing the question. These were removed for data analysis. McNemar *P*-values were < 0.001 for all 10 questions.

DISCUSSION

The ways in which residency programs and potential applicants interact will continue to change as the COVID-19 pandemic fluctuates and resolves. In this study we were able to show improvement toward agreement from pre- to post-event surveys after virtual recruitment events. The data clearly demonstrates through the students' responses to questions that they not only obtained information about the program (number of elective rotations, general curriculum, emergency department layout, presence of specialty tracks, fellowship potential), but also information regarding the culture and "feel" of a program, which can sometimes be challenging to convey. Additionally, the results demonstrate that students were not only provided with tools for contacting program members, but that they were comfortable doing so after attending one of these sessions. As this study was designed to identify the perceived benefit of a virtual information session, further research opportunities include directly assessing applicant knowledge of residency-specific details.

As new techniques and ideas are developed to navigate a new virtual normal, it is important to ensure that students can make appropriate decisions about where they would like to match for residency. Many of these virtual sessions were developed to address the 2020-2021 travel and visiting restrictions. However, this type of event will likely be beneficial in the future as well. These virtual gatherings can continue to be used as a tool by programs to help showcase their culture, community, and strengths. They can also provide an opportunity for students who are unable to physically visit programs gain more information about a residency program.

LIMITATIONS

We identified various limitations throughout this research experience. The most significant limitation was the

Table 3. Knowledge score comparison before and after the virtual town hall meetings with medical students (n = 75 pre-post paired responses).

Questions	Pre-score				Post-score				
	Min	Mean	Median	Max	Min	Mean	Median	Max	P*
I am familiar with the general curriculum of the program.	1	3.19	3	5	2	4.35	4	5	<0.001
I am familiar with the number of elective rotations at the program.	1	2.84	3	5	2	4.2	4	5	<0.001
I am familiar with the general layout of the ED.	1	2.44	2	5	2	3.94	4	5	<0.001
I am aware of the different specialty tracks offered at the program.	1	2.68	2	5	2	4.14	4	5	<0.001
I am aware of the different post-residency fellowships offered by the program.	1	2.67	2	5	2	4.17	4	5	<0.001
I know what types of recreational activities I can experience in AZ.	1	3.36	4	5	1	4.43	5	5	<0.001
I have a good understanding of the culture of the residency community.	1	2.85	3	5	3	4.59	5	5	<0.001
I am interested in applying for a residency position at this program.	1	4.48	5	5	4	4.87	5	5	0.0011
If I have questions about the program, I am comfortable reaching out to a member of the program.	1	3.93	4	5	3	4.76	5	5	<0.001
I have contact information for members of the program and residency leadership to allow for further discussion.	1	3	3	5	2	4.73	5	5	<0.001
Composite score (maximum possible is 50 using all 10 questions).	10	31.45	32.19	50	30	44.2	45	50	<0.001

Values corresponding to the level of agreement: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree
*Wilcoxon signed-rank P-value based on the students who responded to both pre- and post-surveys.
ED, emergency department; *AZ,* Arizona.

Table 4. Composite scores for 75 respondents who responded to both pre- and post-surveys

Composite score (Maximum possible = 50)		Pre-survey	Post-survey	P
Overall				
All respondents	N	75	75	
	Mean	32.70	45.04	<.0001
	Median	33.00	45.00	
	Min	11.00	36.00	
	Max	49.00	50.00	
Location				
Site 1	N	35	35	
	Mean	32.57	46.23	<.0001
	Median	33.00	47.00	
	Min	11.00	41.00	
	Max	47.00	50.00	
Site 2	N	24	24	
	Mean	32.92	43.75	<.0001
	Median	32.50	44.50	
	Min	24.00	36.00	
	Max	49.00	50.00	
Site 3	N	16	16	
	Mean	32.68	44.38	<.0001
	Median	33.30	44.50	
	Min	19.98	39.00	
	Max	42.18	49.00	

Table 5. Dichotomized levels of agreement of the respondents to the questions before and after the intervention.

		Post-intervention response, count (percentage)			P*
	Pre-intervention response, count (percentage)	Neutral, disagree, or strongly disagree	Agree or strongly agree	Total	
Question 1: I am familiar with the number of elective rotations at the program; n (%).	Neutral, disagree, or strongly disagree	1 (1.33)	23 (30.67)	24 (32)	<0.001
	Agree or strongly agree	0	36 (48)	36 (48)	
	Missing response (excluded for analysis)	1 (1.33)	14 (18.67)	15 (20)	
	Total	2 (2.67)	97.33	100	
Question 2: I am familiar with the number of elective rotations at the program; n (%).	Neutral, disagree, or strongly disagree	6 (8)	38 (50.67)	44 (58.67)	<0.001
	Agree or strongly agree	1 (1.33)	30 (40)	31 (41.33)	
	Total	7 (9.33)	68 (90.67)	75 (100)	
Question 3: I am familiar with the general layout of the ED; n (%).	Neutral, disagree, or strongly disagree	15 (20)	46 (61.33)	61 (81.33)	<0.001
	Agree or strongly agree	0 (0)	14 (18.67)	14 (18.67)	
	Total	15 (20)	60 (80)	75 (100)	
Question 4: I am aware of the different specialty tracks offered at the program; n (%).	Neutral, disagree, or strongly disagree	7 (9.33)	46 (61.33)	53 (70.67)	<0.001
	Agree or strongly agree	0 (0)	22 (29.33)	22 (29.33)	
	Total	7 (9.33)	68 (90.67)	75 (100)	
Question 5: I am aware of the different post-residency fellowships offered by the program; n (%).	Neutral, disagree, or strongly disagree	6 (8)	41 (54.67)	47 (62.6)	<0.001
	Agree or strongly agree	1 (1.33)	27 (36)	28 (37.33)	
	Total	7 (9.33)	68 (90.67)	75 (100)	
Question 6: I know what types of recreational activities I can experience in the city; n (%).	Neutral, disagree, or strongly disagree	1 (1.33)	24 (32)	25 (33.33)	<0.001
	Agree or strongly agree	0 (0)	50 (66.67)	50 (66.67)	
	Total	1 (1.33)	74 (98.67)	75 (100)	
Question 7: I have a good understanding of the culture of the residency community; n (%).	Neutral, disagree, or strongly disagree	3 (4)	50 (66.67)	53 (70.67)	<0.001
	Agree or strongly agree	1 (1.33)	21 (28)	22 (29.33)	
	Total	4 (5.33)	71 (94.67)	75 (100)	
Question 8: I am interested in applying for a residency position at this program; n (%).	Neutral, disagree, or strongly disagree	0 (0)	5 (6.67)	5 (6.67)	<0.001
	Agree or strongly agree	0 (0)	70 (93.33)	70 (93.33)	
	Total	0 (0)	75 (100)	75 (100)	
Question 9: If I have questions about the program, I am comfortable reaching out to a member of the program; n (%).	Neutral, disagree, or strongly disagree	1 (1.33)	21 (28)	22 (29.33)	<0.001
	Agree or strongly agree	0 (0)	53 (70.67)	53 (70.67)	
	Total	1 (1.33)	74 (98.67)	75 (100)	
Question 10: I have contact information for members of the program and residency leadership to allow for further discussion; n (%).	Neutral, disagree, or strongly disagree	0 (0)	36 (48)	36 (48)	<0.001
	Agree or strongly agree	0 (0)	39 (52)	39 (52)	
	Total	0 (0)	75 (100)	75 (100)	

* McNemar test.

low response rate for the surveys. As the design included a pre- and post-event survey with no requirements for completion, there was a large discrepancy between the number of students who registered, completed the pre-event survey, and attended the event, and the number of students who completed the post-event survey. There were fewer participants for the post-surveys relative to the pre-surveys across each of the four locations resulting in fewer matchable pairs available for the pre-post response comparisons. Unfortunately, data was missing or incomplete due to the survey nature, and not all pre- and post-event survey responses could be matched, resulting in some incomplete data. As a result, we are only able to report results from students willing to complete both surveys. Due

to the small data sample size, many of the numerical results may be impacted, and there is a potential for variation in the results. However, our limited data on the responses to questions indicated a dramatic improvement in perceived knowledge, with many areas showing considerable advancement in perceived knowledge of the program. While the individual percentage of improvement could change with a larger sample size, it is unlikely that the overall benefit of virtual information sessions for interested medical students would be rejected.

During the design of the protocol, we determined that comfort of the participants was paramount, as we did not want there to be undue pressure for a student to complete the survey or to feel that there would be a professional consequence associated with participation. Students received one email before the session and one after recruiting them to participate in the survey with no other correspondence, which likely hindered our response rate. Future studies and follow-up questionnaires regarding this topic may improve response rates by sending additional follow-up correspondence. One option would be to use a staff member not associated with the residency to send additional emails and collect responses to maintain objectivity, resulting in another layer of protection for students completing the questionnaire.

Additionally, there was no standardized structure on what was to be included at each of the study site information sessions. Each location was free to promote, advertise, and host its own session or multiple sessions without specific oversight or specific requirements. This was intentionally done to allow for the creativity, personality, and innovation of each program to shine through without external modification. While we emphasized both in writing and verbally our goal of anonymity, some students may have felt pressured to respond to the surveys in a positive nature as they were likely applying for a residency position with the program. Furthermore, as students were self-selecting which information sessions to attend, there is a potential for a positive selection bias. Finally, as these programs were recruiting in the same application cycle, there may have been attendance overlap by medical students participating in the individual surveys. Future studies on this topic may benefit from including sites from different geographic locations and with a wider range of program sizes to further strengthen results.

Additionally, our study questions were targeted for short-term follow-up and did not prove increased familiarity long-term or necessarily affect the program's recruitment of candidates. Additional studies including how attendance at a virtual information session may affect a student's rank list or match results would be areas of future investigation to further examine the benefit of virtual sessions.

CONCLUSION

It is important for medical students and EM residency programs to be able to critically evaluate each other to allow for the best possible match. Hosting virtual meet-and-greet events can be an effective way for programs to attempt to facilitate this type of information exchange when in-person interaction is limited. Attendance at a virtual residency program information session appears to improve the perceived knowledge of curriculum information and program exposure to medical students applying to an EM residency. Residency programs should consider incorporating these types of events to enhance medical student recruitment and convey important program information.

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BREIF RESEARCH REPORT

The Use of a Self-triage Tool to Predict COVID-19 Cases and Hospitalizations in the State of Georgia

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Introduction: The coronavirus 2019 (COVID-19) pandemic has created significant burden on healthcare systems throughout the world. Syndromic surveillance, which collects real-time data based on a range of symptoms rather than laboratory diagnoses, can help provide timely information in emergency response. We examined the effectiveness of a web-based COVID-19 symptom checking tool (C19Check) in the state of Georgia (GA) in predicting COVID-19 cases and hospitalizations.

Methods: We analyzed C19Check use data, COVID-19 cases, and hospitalizations from April 22– November 28, 2020. Cases and hospitalizations in GA were extracted from the Georgia Department of Public Health data repository. We used the Granger causality test to assess whether including C19Check data can improve predictions compared to using previous COVID-19 cases and hospitalizations data alone. Vector autoregression (VAR) models were fitted to forecast cases and hospitalizations from November 29 - December 12, 2020. We calculated mean absolute percentage error to estimate the errors in forecast of cases and hospitalizations.

Results: There were 25,861 C19Check uses in GA from April 22–November 28, 2020. Time-lags tested in Granger causality test for cases (6-8 days) and hospitalizations (10-12 days) were significant (P= <0.05); the mean absolute percentage error of fitted VAR models were 39.63% and 15.86%, respectively.

Conclusion: The C19Check tool was able to help predict COVID-19 cases and related hospitalizations in GA. In settings where laboratory tests are limited, a real-time, symptom-based assessment tool can provide timely and inexpensive data for syndromic surveillance to guide pandemic response. Findings from this study demonstrate that online symptom-checking tools can be a source of data for syndromic surveillance, and the data may help improve predictions of cases and hospitalizations.
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INTRODUCTION

The coronavirus 2019 (COVID-19) pandemic has created significant burden on healthcare systems throughout the world.[1] Syndromic surveillance has been used along with traditional disease surveillance to identify potential outbreaks by using automated data systems to detect early threats.[2-4] The system can collect real-time data based on a range of symptoms rather than laboratory diagnoses, increasing the

ability to provide timely information in emergency response.[4] Early in the pandemic, several countries used syndromic surveillance by monitoring telehealth calls and suspected COVID-19 cases presenting to care.[4] Studies in Europe and Asia have found that self-reported symptoms collected through mobile applications had strong spatial correlations with confirmed COVID-19 cases[5] and that by collecting data before and after COVID-19 restrictions, the tool was effective in evaluating control measures.[6]

In April 2020, C19Check.com (C19Check) was launched by Emory University and Vital Software Inc. in Atlanta, Georgia (GA). The online symptom tracker, freely available in 31 languages, prompts users to report their symptoms and then generates evidence-based summaries of risk of COVID-19 infection and advice for seeking healthcare. We sought to examine the usefulness of C19Check as a syndromic surveillance tool in GA by assessing whether C19Check use can predict COVID-19 cases and hospitalizations. The findings have important implications on novel methods for syndromic surveillance during current and future pandemics.

METHODS

We analyzed C19Check use by location from April 22–November 28, 2020. Daily incident COVID-19 cases and hospitalizations in GA over the same period were extracted from the Georgia Department of Public Health (GDPH) data repository. COVID-19 cases were identified through positive molecular and antigen tests. Hospitalizations were based on confirmed cases hospitalized at the time the case was reported to GDPH or interviewed. C19Check use was defined as the number of online forms completed per day. We excluded from the analysis users who reported a ZIP code outside of GA.

To examine whether C19Check use can predict COVID-19 cases and hospitalizations, we conducted a Granger causality test[7] for cases and hospitalizations separately with C19Check use. First, we took the log of cases/hospitalizations and C19Check use and applied a unit root test to determine data stationarity.[8] For hospitalizations, the data was not stationary; so we applied the first difference and conducted the Johansen co-integration test to assess stationarity. Vector autoregression models (VAR) were fitted with different time-lags, and the time-lag with minimum Akaike information criterion for best fit was selected (seven days for cases and 11 days for hospitalizations).

We conducted hypothesis testing with a Granger causality test to determine whether including C19Check use can better predict cases and hospitalizations separately than including cases or hospitalizations data alone in the models, respectively. Time-lags of 6-8 days (cases) and 10-12 days (hospitalizations) were selected for the test to account for time-lag sensitivity in the Granger causality test. Following hypothesis testing, separate VAR models were fitted to predict cases and hospitalizations in GA from November 29–December 12, 2020. We calculated mean absolute percentage error (MAPE) to estimate the errors in forecast of cases and hospitalizations. All analyses and plots were created in R version 4.1.0 (RStudio; Boston, MA). The study was reviewed by the institutional review board (IRB), which determined that IRB review and oversight was not required as the project did not meet the criteria for human subjects' research.

RESULTS

From April 22–November 28, 2020, there were 85,996 total C19Check uses, of which 25,861 uses were in GA. During the study period, the peak C19Check uses were on July 7 and November 20. The highest daily COVID-19 cases were on November 21 and July 24, while the highest daily hospitalizations were on July 13 and 10, 2020.

All time-lags for C19Check use and COVID-19 cases were significant (P=< 0.05) in the Granger causality test. This indicates that information on C19Check use six to eight days prior to a specific date between April 22–November 28, 2020 was better able to predict COVID-19 cases on that date than using the prior information on COVID-19 cases alone. In the VAR model fitted with a time-lag of seven days, we predicted cases from November 29–December 12, 2020 and found that MAPE was 39.63% (Figure 1).

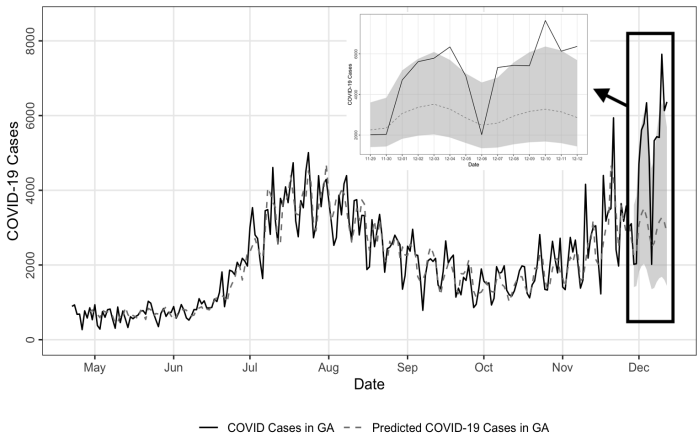

Figure 1. Epidemic curve of measured daily COVID-19 incident cases and C19Check-predicted COVID-19 cases from April 22–December 12, 2020 in the state of Georgia. The upper and lower confidence intervals (gray shading) from the fitted VAR model with a time-lag of seven days are depicted from November 29–December 12, 2020.

For COVID-19 hospitalizations, results were significant for all time lags (P <0.05) in the Granger causality test. We found that including information on C19Check use in the model was more useful in predicting hospitalizations than including information on hospitalizations alone. In the VAR model fitted with a time-lag of 11 days, the MAPE for predicted hospitalizations was 15.86% (Figure 2).

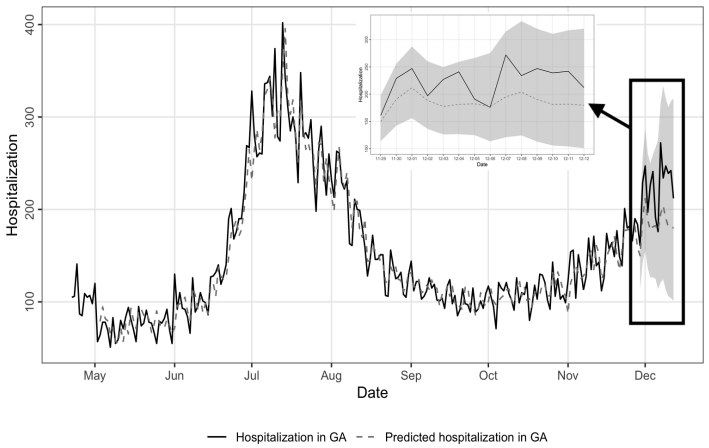

Figure 2. Epidemic curve of measured daily incident COVID-19-related hospitalizations and C19Check-predicted COVID-19 related hospitalizations from April 22–December 12, 2020 in the state of Georgia. The upper and lower confidence intervals (gray shading) from the fitted VAR model with a time-lag of 11 days are depicted from November 29–December 12, 2020.

DISCUSSION

By including C19Check use in the Granger causality test, we increased our ability to predict daily COVID-19 cases and hospitalizations compared to using information on cases and hospitalizations alone. In the fitted VAR models, the MAPE for cases and hospitalizations predictions were 39.63% and 15.86%, respectively. The amount of error in the forecast is likely because C19Check use itself is not a cause of the surges and declines in cases and hospitalizations. The significant results for all time-lags tested indicate that our findings on the predictability of C19Check use were not impacted by time-lags, demonstrating the effectiveness of C19Check as a tool for syndromic surveillance of COVID-19 cases and hospitalizations in GA. Other real-time syndromic surveillance tools have been used to detect early signals, monitor population transmission dynamics and identify hotspots in different countries[5,6,9,10] and various regions of the US.[9,11] However, we also evaluated the performance of an internet-based self-triage tool in predicting COVID-19 cases and hospitalizations.

LIMITATIONS

There are several limitations to our study. First, since COVID-19 is a novel virus, the reporting of cases and hospitalizations changed throughout the pandemic. Testing capacity was limited early on, and case counts were likely underestimated. The reporting of hospitalization data from GDPH did not reflect those currently hospitalized with COVID-19 and likely underestimated the actual total number of hospitalizations. Second, the use of C19Check requires volitional community participation and its users may not be generalizable to the overall GA population. Third, as the pandemic progressed in the winter of 2020-2021, we observed reduced C19Check use despite the surges in COVID-19 cases, hospitalizations, and deaths as well as the presence of variants. This may be due to a combination of factors including the increase of available predictor tools, "pandemic fatigue" leading to relaxation of precautions,[12] and a better general understanding of COVID-19 symptoms with less reliance on web-based tools. However, C19Check was able to predict cases and hospitalizations despite these limitations. A major strength of our study is the availability of data beyond the initial months of the pandemic, which allowed us to examine the effectiveness of C19Check to predict cases and hospitalizations during surges and declines.

CONCLUSION

The use of self-triage tools such as C19Check can help predict cases and hospitalizations during the pandemic. In settings where laboratory tests are limited, contact tracing is challenged and public health responses are hindered by the lack of information on incident cases, infection rates, and transmission dynamics,[13] a real-time, symptom-based assessment tool can provide timely and inexpensive data for syndromic surveillance in order to guide pandemic response.[13] Further research is warranted to understand the factors influencing predictability and evaluate the impact of the tool on healthcare systems. C19Check and other interactive web-based platforms have highlighted an opportunity for self-triage tools to predict trends and guide public health measures in pandemic response.

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Strategies in Emergency Department-based COVID-19 Vaccination

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Emergency departments (ED) function as safety nets for vulnerable patient populations with limited access to healthcare. As such, EDs can play a critical role in advancing public health priorities such as vaccination for coronavirus 2019 (COVID-19) during the ongoing pandemic. Precedents for ED-based vaccination exist: established and routine ED-vaccination practices include tetanus prophylaxis in wound care[1,2] and hepatitis B vaccination in cases of occupational exposures and sexual assault.[3] Emergency departments have also previously delivered seasonal influenza vaccinations.[4–6] Herein, we present our experiences providing COVID-19 vaccinations from the ED of an academic public hospital, based on a program developed immediately preceding the local surge of the COVID-19 Delta variant in a large metropolitan city.

The hospital where the ED COVID-19 vaccination initiative took place is a Level I trauma center with an annual ED visit volume of approximately 80,000 pre-pandemic; it is the central public healthcare facility for the city and surrounding county. Over half of the patient population is uninsured (53.6%) and over three-quarters are Black and/or Latinx (81.9%), with many lacking regular access to healthcare.[7] It is notable that these racial and ethnic groups have been disproportionately affected by COVID-19 in the US.[8] Structural determinants of inequity such as unjust policies, economic inequality, and discrimination are pervasive issues in our community that have adverse downstream effects on our patients' social determinants of health.[9]

A recent study in this ED's population showed a high prevalence of financial resource strain and lack of reliable transportation as barriers to healthcare access before the pandemic.[10] As the Delta variant began to surge locally in July 2021, the county's vaccination rate was 42%,[11] far below the goal of the approximate 70% needed for herd immunity.[12] This low vaccination rate reflects both the strength of the state anti-vaccination movement[13] as well as local barriers to healthcare access.[9] Minimal access to primary care, infrequent healthcare seeking, and relatively lower availability of vaccines geographically in racial/ethnic minority communities[14,15] limit opportunities for indigent patients to receive COVID-19 vaccination. Mindful of this, our multidisciplinary team implemented an intervention with the goal of delivering equitable access to vaccinations.

From March 2021 to the present day, a leadership team of emergency physicians, ED nurses, and hospital pharmacists developed a protocol to offer the first dose of the two-dose Pfizer or Moderna vaccines or the single-dose Johnson & Johnson vaccine to ED patients likely to be discharged. This protocol was undertaken as a quality improvement initiative, rather than formal research overseen by the hospital system's institutional review board. Eligible patients have not been vaccinated for COVID-19, do not have active COVID-19 symptoms, and have not had an allergic reaction to the mRNA COVID-19 vaccine or any of its components. The process is as follows:

1) The clinician evaluating an eligible patient offers the vaccination, discusses its benefits and riskswith the patient, and obtains informed consent for vaccination;
2) the evaluating clinician places an order in the electronic health record (EHR) for the vaccine type the patient elects;
3) the evaluating clinician communicates with the area charge nurse regarding vaccine administration.

Patients are monitored for allergic reactions for 15 minutes after receiving a vaccine dose. Through the EHR, a list of patients who elect to receive the first dose of the Pfizer or Moderna vaccine is generated, allowing a scheduler to contact them regarding follow-up appointments for second vaccination doses. If they prefer to self-schedule, patients also receive

verbal and written information at the time of discharge about how to access our health system's online patient portal, which allows them to choose any clinic or hospital location within our health system for a second-dose vaccination appointment.

The above protocol and brief materials to guide counseling about benefits and risks of vaccination were distributed to emergency physicians, advanced practice clinicians, and nurses by email in July 2021. The email included a screenshot of how to order the vaccine through the EHR and a PowerPoint slide of sample language about vaccine safety and efficacy. A reminder email followed approximately two weeks later. Members of the vaccination leadership team additionally performed ED administrative walkthroughs several times per week to encourage clinicians to offer vaccination and use the protocol above.

From July–December 2021, the ED administered COVID-19 vaccines to 357 patients. Of these, 39% received the Johnson & Johnson (n = 139), 46% received the Pfizer (n = 166), and 15% received the Moderna vaccine (n = 52). More than half of the vaccines were administered in July and August 2021, immediately prior to and at the start of the local COVID-19 Delta surge (n = 205, 57%). A total of 111 of ED staff clinicians participated in vaccine administration, with 84% of attending physicians (n = 43), 76% of advanced practice clinicians (n = 13), and 67% of resident physicians (n = 29) using the protocol.

As an ED administrative vaccine working group, we met biweekly to identify and discuss challenges associated with the ED COVID-19 vaccination initiative and potential strategies to overcome them. Clinicians' time constraints represent a challenge to routinely offering COVID-19 vaccination to eligible patients. Determining a patient's vaccination status and counseling about COVID-19 vaccination can take several minutes per encounter, as EHRs of COVID-19 vaccination across health systems are not always mutually accessible. Conversations about benefits and risks can also entail a time commitment, particularly as clinicians must address possible side effects of vaccines and often engage patients about publicly circulating misinformation and conspiracy theories.[16] In light of these issues, emergency clinicians may deprioritize offering COVID-19 vaccination to eligible patients, particularly in the face of competing tasks when caring for multiple patients with conditions of varying acuity. Given the high volumes and crowding common in EDs,[17] emergency clinicians value rapid disposition and may have concerns over potentially extending a patient's length of stay by offering a COVID-19 vaccination. Vaccine administration and post-vaccination monitoring also presents additional tasks for emergency nurses and hospital pharmacists. Notably, vaccines are delivered from the hospital pharmacy, and delays in administration may occur when medications for critically ill patients are prioritized elsewhere in the ED. Similar operational challenges have been identified in ED vaccination campaigns for other infectious diseases.[5,6]

We have undertaken several strategies to overcome challenges related to clinicians' time constraints. First, we encourage triage and medical screening staff to include a brief mention of a patient's COVID-19 vaccination status in their documentation whenever possible, which can prompt subsequent evaluating clinicians to offer vaccination. Second, we encourage clinicians to identify and offer vaccination to ambulatory patients early on in their ED visit after addressing a patient's acute medical concerns. When offered to patients waiting for laboratory or imaging studies, vaccination can occur in parallel with workup rather than adding to ED length of stay. Third, as ours is a teaching institution, patients may engage with a junior resident or advanced practice clinician fellow, senior resident, and attending physician during their visit. Flexibility in which clinician explores a patient's receptivity to vaccination is essential, with the care team delegating conversation about vaccination to the clinician with greatest bandwidth at a particular time. We promoted these strategies at staff meetings in August 2021, but experienced severe staffing shortages in September 2021 that were associated with a decline in vaccine administration. Accordingly, we cannot offer that these strategies led to increased vaccination. However, our administrative team received endorsement of the second and third strategies from the 10 clinicians who vaccinated the most patients from July–December 2021.

Patient receptivity to COVID-19 vaccination in the ED varies, as in the United States more broadly.[18] Publicly circulating misinformation about COVID-19 vaccines, conspiracy theories,[16] and reports of rare side effects and prior pause in administration of the Johnson & Johnson vaccine discourage some patients from vaccination. Historical injustices that biomedical establishments have perpetrated against racial minorities are part of collective community memory and contribute to mistrust of medical personnel.[19–21] Similar findings are documented about acceptability of vaccination in Black and Latinx populations elsewhere.[22] For some of our patients, particularly among those who are ethnic minorities, clinical decision-making occurs through family discussions, and even if a patient desires vaccination, opposition from a spouse or adult child caregiver can lead the patient to decline.

There are no simple solutions to address these complex sociocultural and structural barriers, particularly in short encounters between a patient and an emergency clinician who lack a longitudinal therapeutic relationship. Through our working group meetings and discussions with emergency clinicians who vaccinated the highest number of patients, we identified several potential facilitators to vaccine acceptance. While we have not yet formally evaluated these strategies' effect on performance or impact measures, we offer the following as areas of future inquiry.

First, when a clinician discloses their own experience of COVID-19 infection or the loss or suffering of loved ones, this can foster relatability and make an abstract concept concrete and immediate. Second, disclosing one's personal or

familial experience of vaccination as a clinician can encourage vaccination among patients—for example, establishing a shared identity as a parent living with unvaccinated children or wanting to protect an eligible teen attending school. Third, in our teaching institution, multiple clinicians can reinforce each other's recommendations. Hearing the same messages about the benefits of vaccination outweighing risks from a resident physician, advanced practice clinician, and attending physician may help reassure patients about vaccine safety and efficacy. Finally, the notable diversity of our ED staff likely plays a role in fostering trust and opening conversations with our diverse patient population.

In the 2020 academic year, 60% of residents identified as underrepresented in medicine (URM), with 30% Black and 30% Hispanic. Of faculty, 34% identify as URM. While we have not formally studied these dynamics, some Spanish-speaking patients have commented to Latinx or Spanish-speaking clinicians that they are grateful for the opportunity to discuss the vaccine with their physician directly in their native language. Black patients have also expressed positive feelings about discussing vaccination with Black physicians. Given vaccine hesitancy in Black and Hispanic populations,[22] it is notable that patients made these comments specifically about vaccination discussions, rather than other medical treatment and educational discussions for which they originally sought medical care. At the same time, literature does suggest that physician-patient racial concordance is associated with higher patient satisfaction regarding communication for other medical conditions.[23] Physician-patient language and racial concordance is not feasible in all encounters, and clinicians may rely on interpreters and other means of establishing rapport. However, our experiences highlight the potential role of a diverse healthcare workforce to foster trust and improve perceptions of communication with racial/ethnic minority and limited English-proficiency patient populations.

It is worth noting that some of our ED patients quickly and readily accept vaccination when we offer it. These patients sometimes express that they had wanted to get the vaccine for months but had not done so due to limited engagement with healthcare establishments (eg, not having seen a clinician for years due to lack of health insurance). Some of our undocumented patients have disclosed fears that providing their personal or contact information could threaten their immigration status. In some cases, reassurance about contact information being used for follow-up vaccination led undocumented patients to feel comfortable to provide a phone number, either their own or that of a relative. In other cases, undocumented patients appreciated the option to self-schedule a second dose through the online patient portal.

We recognize multiple limitations in our approach. Our program was implemented during the Delta surge, which was quickly followed by the Omicron surge. During these times, our department and hospital system experienced severe staffing shortages, high patient volumes, and limited availability of information technology analysis services. As such, we were not able to track and are unable to provide information about the number and proportion of ED patients who were offered and declined COVID-19 vaccination. Schedulers for second- vaccine doses covered referrals from outpatient, urgent care, and emergency care in the hospital system, and information was not tracked about success rates of reaching ED patients needing a second vaccination or the proportion of ED patients who successfully received a second vaccination. We did not formally study the effects of our initiative on overcoming barriers to vaccination or of physician-patient racial or language concordance on vaccine communication and cannot provide performance or impact measures. Finally, because COVID-19 vaccination involves two doses and boosters, our experiences may not be applicable to vaccinations that either do not require follow-up dosing (eg, tetanus) or whose follow-up dosing is managed by occupational health entities (eg, hepatitis B).

Despite these limitations, we share our experiences in hopes that other EDs can benefit and capitalize on the unique safety net role that the ED plays in the US health system. COVID-19 vaccination from the ED can also pave the way for other important types of vaccination, whether broad initiatives such as seasonal influenza vaccination at the community level, or targeted efforts such as pneumococcal vaccination for individuals with sickle cell disease or for older adults. Emergency medicine is a specialty that prides itself on saving lives. Primary prevention through ED vaccination is a crucial way to accomplish this goal.

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The Use of Non-physician Prescribed Medications in Patients Presenting to Two Emergency Departments in a Low/Middle-income Country

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Introduction: With few trained healthcare practitioners and limited personal finances, many patients in low/middle income countries purchase prescription medications from non-physician prescribers (NPP). This study documents various aspects of this practice, including patterns of prescribing, and the patient's understanding of medication risks.

Methods: From January to April 2017, 479 patients entering two hospitals in Phnom Penh, Cambodia, were surveyed. Demographics, medications, types of NPP who provided the medication, patients history and physicians' chart data were documented. Information, including symptoms when the medication was purchased, possible side effects, hospital presenting symptoms, etc, was recorded. The patient's understanding of medication allergies and risk of serious side effects was also documented.

Results: Of the 467 patients included, more than half (59%), reported buying medications from NPPs within the two weeks before presenting to the hospital. Nearly half of those patients, (42%), could not identify any of their medications. Of those 159 patients who could identify at least one drug, 79% bought at least one medication that would require a prescription in the United States. Only 8% of patients were aware that medications could cause serious harm. Twenty-three percent of the known medications were oral or injectable corticosteroids, and 56% of steroid users, typically chronic users, had evidence of possible side effects.

Conclusion: Many patients in one low/middle income country received prescription medications from various NPPs with little information concerning these medications. Efforts to educate the public about their medications and the potential risks of medications are needed. [West J Emerg Med. 2022;23(4)540–547.]

INTRODUCTION

Background

Cambodia is a rapidly developing country in Southeast Asia that suffered a decimation of its doctors and medical staff during the Pol Pot regime in the 1970-90s. According to 2014 World Bank data, 40% of the countries around the world have fewer than one doctor/1000 people, with Cambodia having only 0.2 doctors/1000.[1,2] In particular, Cambodia's rural areas are often without any physicians. Non-physician prescribers (NPP) frequently fill the void in those regions, though many may have no formal medical training. Some NPPs focus primarily on selling medication, providing guidance to patients as to which medication to buy based on their symptoms. Other NPPs may open private practices and, in

addition to providing advice after clinical evaluation, may sell medication. Some of these NPPs may be trained nurses, though unlikely trained as nurse practitioners. Other practitioners, however, may have only been trained as a nurse's aide observing physicians in a hospital setting or, in earlier times, at a refugee camp, before opening their own practice. Small villages may have governmental health centers, some staffed with trained mid-level healthcare personnel, others with staff who have uncertain training.

Licensed pharmacists may also be limited in these regions. Even where pharmacies exist, the staff behind the counter providing prescription advice may have had no pharmaceutical training but may simply be the pharmacist's relative, or other non-medically trained staff. Retail shops can also sell prescription medications, with the store clerk providing medication guidance. Finally, medications and medical advice may come from village healers providing traditional Khmer medication.[3] While traditional medication is typically herbal, a number of Cambodian doctors believe prescription medication may be added into some of the herbal mixtures, creating a potential source of unknown prescription medication. Literature describing this practice is difficult to find. The Ministry of Health has reportedly banned this type of mixed "traditional" medicine, but hospital staff indicate it is still sold **(Figure 1).**

Population Health Research Capsule

What do we already know about this issue?
Antibiotics are frequently bought in low / middle income countries without an approved healthcare clinician's consultation, yet little has been documented concerning other medications.

What was the research question?
What is the scope of all types of prescription medication usage without consultation? Do patients understand medication risks?

What was the major finding of the study?
More than half of 467 patients (59%), reported buying medications from non-physicians and nearly half (42%), could not identify them. Three-quarters required prescriptions in the US. Only 8% were aware they could cause serious harm.

How does this improve population health?
This study highlights the need for patient education concerning medication usage and risks in one low/middle income country.

Importance

In the United States, where prescription medication is only provided by licensed healthcare workers, medication errors account for a significant proportion of overall medical errors.[4,5] However, in many, if not most, parts of the world, prescription medication can be bought by patients without a doctor's prescription or consultation with an appropriately licensed practitioner.[6-26] This may be because doctors are unavailable, lack of trust in the medical establishment, or patients simply can't afford both a doctor's consultation and the recommended medications. While information regarding the dispensing of antibiotics without prescriptions by pharmacists can be found in the literature, limited information is available concerning the scope and details of all types of non-physician prescribing.[27-32] Additionally, many global healthcare volunteers coming from countries with highly regulated prescription practices may initially be unaware of the various types of informal prescribing practices present in developing regions.

Figure 1. Examples of "Khmer traditional medication" with possible admixture of prescription medication. (Acetaminophen caplet for size comparison.)

Goals of this Study

This study has two goals. First, the study describes the scope and details of the prescribing practices of NPPs in one low/middle income country, including patterns of prescribing for the most commonly used medications and possible side effects from these medications. Second, the study attempts to characterize the patients' understanding of medication adverse effects and risks.

METHODS

Study Design and Setting

This prospective, observational study was conducted between January and April 2017 at two sites: (1) Sihanouk Hospital Center of Hope (SHCH) and (2) Hope Worldwide Community Health Center (CMC)], in Phnom Penh, Cambodia, after institutional review board approval by the participating medical centers and the Cambodian Ministry of

Health. The two sites included emergency departments with approximately 90 patient visits/day, one for paying patients and one for indigent patients. Both sites are staffed by the same group of physicians. The two hospitals primarily see adult patients with various medical problems. Pediatric, gynecology/obstetric, psychiatric and major trauma patients are rarely seen in the EDs because most patients self-refer to other hospitals. Known human immunodeficiency virus (HIV) patients were seen by infectious disease physicians separately.

Selection of Participants

A convenience sample of stable, consenting patients visiting one of the two study sites was eligible for enrollment after triage by a nurse (**Figure 2)**. Two trained, bilingual Cambodian nurse research assistants (RA) assessed whether patients met inclusion criteria and then verbally administered the survey to all patients. All patients were eligible except those requiring immediate medical care. However, those not initially eligible could become eligible for enrollment after their condition had stabilized. All patients gave written or thumbprint informed consent.

Intervention and Measurements

A 34-item questionnaire (**Appendix A**) was verbally administered by a trained RA to those using medication provided by NPPs within two weeks before presentation. This questionnaire covered medication name, dose/duration, expiration dates, prescriber, reason patient requested treatment, and the response to treatment; ie, did they improve or develop new symptoms/possible side effects after starting the medication. Patients were asked whether they requested medical advice from the prescriber and if the prescriber asked questions, such as other symptoms, past medical history, other medications, allergies, or pregnancy. Also noted were prescriber instructions (verbal only or written), prescriber information concerning adverse effects, and the patient's understanding of the term "medication allergy" and serious side effects.

After physician evaluation, information was obtained from the medical chart including discharge diagnosis, past history, and ancillary tests. Medication side effects were included as "possible" side effects, if a new symptom had started after the medication had been used and this symptom is a known side effect of that drug. Specific medication side effects were not asked by the RAs, but once a patient reported new symptoms, the RAs and the authors (some of whom were present during the first month of data collection) were encouraged to ask further details to help clarify the likelihood the symptom was related to the medication. For instance, one patient who self-prescribed chronic steroids for no known reason, brought in recent radiographs demonstrating progressive bilateral femoral head necrosis. He was further questioned concerning other possible known risk factors associated with the condition (none were noted), and so was included as a "possible" medication side effect. Patients using both non-steroidal anti-inflammatory drugs (NSAID) and steroids for chronic pain frequently complained of post-use gastric irritation, and some were noted to have iron deficiency anemia. While the NSAIDs alone could have caused the symptoms or the patient may have had undiagnosed anemia even before the start of the medication, this would still have been included as a "possible" steroid side effect since the medication combination is known to increase the risk of gastric irritation and bleeding.

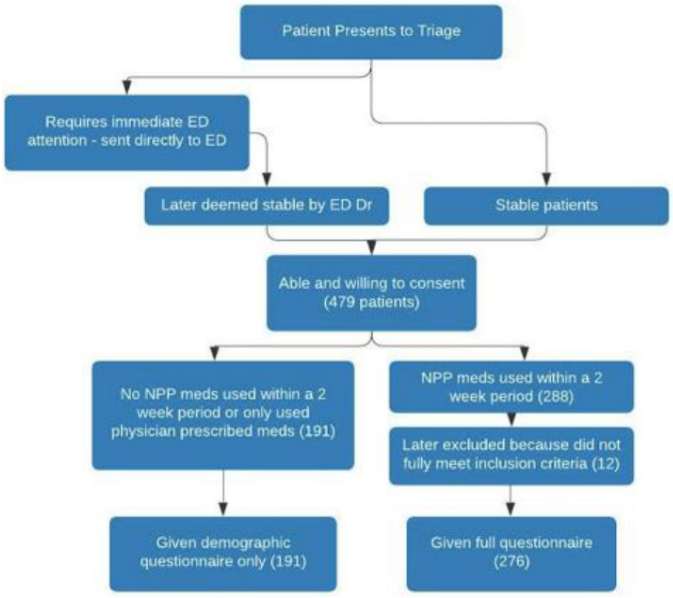

Figure 2. Enrollment criteria for stable patients in Cambodia studied for identification and knowledge of their current medications.*ED*, emergency department; *NPP*, non-physician prescriber.

Outcomes

First, the study documents various aspects of NPP prescribing practice. This also included evaluating prescribing patterns for the most commonly used medications (determined after the study's completion) and noting any possible medication side effects reported by patients for these medications. Secondly, the study evaluates the patient's understanding of medication risks.

Data Analysis

Descriptive statistics were used to summarize the data. Categorical data were summarized as counts and percentages frequency of occurrence. Continuous data were summarized as means and standard deviations. Because this was not a hypothesis-testing study, no formal sample size calculation was performed. The study was conducted over a four- month period during which funding and research personnel were available.

RESULTS

Characteristics of Study Subjects

During the study period, 479 patients were enrolled. Twelve were excluded, either because their recorded

medications were used before the two-week study cutoff or a physician potentially prescribed their medications. Of the remaining 467 patients, 276 (59%) patients reported buying medications from various NPPs within the two weeks before presenting to the hospital. Mean age was 53 years (range 15 – 85) and 68% were female. Patients travelled an average of 2-2.5 hours from home to hospital, 72 % required assistance to pay for services, and 70% were able to read at an elementary level or higher. There were 191 (41%) patients who did not use any medications or only physician-prescribed medication in the two weeks before presentation.

Main Results – Prescribing Practices

Of the 159 patients who knew the name (or brought in the labels) of at least one medication, 79% purchased at least one medication that would require a prescription in the US. The 176 known prescription medications commonly fell into several categories: antihypertensives 44 (25%); oral/intravenous steroids 40 (23%); oral antibiotics 35 (20%), oral antihyperglycemics 19 (11%); and sedatives/narcotics 15 (9%). Twenty-three (13%) other types of medications were also documented. This data does not include those who used unknown injectables (n=53), most of which would require a prescription in the US. It also does not include the "Khmer traditional medication" (n=32) that RAs believed, based on the patient's description, might be mixed with prescription medications. Patients who described taking purely herbal Khmer traditional medications were not included.

The most common "prescribing" source was a "retail" source (45%), either a store salesperson or an individual medication seller who helped guide the patient in buying medication. **The table** lists other prescribing sources. A small number of patients were unable to distinguish whether their prescriber was a doctor or another type of practitioner. Others could not distinguish a store clerk from a pharmacist.

Few NPPs asked patients for additional medical information before prescribing. For example, only 17 patients (6%) reported being asked about allergies, and most of these patients already had a history of allergy and likely informed the prescriber themselves. Only 13 sellers (5%) provided any information about the potential adverse effects of the medications; however, most sellers did provide dosing instruction. One hundred eighty-eight patients (68%) received only verbal instructions, and 56 patients (20%) received written instructions. Thirty-one patients (11%) did not request any help when purchasing the medication. **Figure 3** provides common examples of "written instructions."

Patient Understanding of Medication Risks

Of the responding 273 patients, (90%) did not understand the term "medication allergy." The 10% that did typically had suffered a medication reaction in the past. Twenty-six NPP medication users (9%) stated they had an allergy, describing symptoms that could be consistent with a possible allergy, but many were not sure which past medication caused the reaction. Only 23 patients (8%) were aware that medications could cause serious reactions (again, usually those with past drug reactions).

Table. Source of medications.

Who prescribed medication	Number (%), total sources (N = 344)*
Retail store clerk or individual medication seller	156 (45)
Patient uncertain whether store clerk or pharmacist **	47 (14)
Non-physician healthcare worker at village governmental clinic	46 (13)
Non-physician healthcare practitioner (may or may not have medical training)	25 (7)
Pharmacist	20 (6)
Patient uncertain whether physician or non-physician practitioner ***	17 (5)
Friend/relative	17 (5)
Self	16 (5)

* Some patients (N = 65) used multiple sources when purchasing medication.
** Pharmacies may hire sellers who advise patients but may not be pharmacists.
*** Research assistants were allowed to include "uncertain" practitioners if, based on location (ie, rural) and other factors (ie, signage on front door), it was determined the chance of being a physician was highly unlikely.

Prescribing Patterns and Reported Side Effects

While the inclusion criteria required patients to have purchased NPP medication within the prior two weeks before presentation, many medication treatments had actually begun months or years prior, particularly anti-diabetic medication, anti-hypertensives, and steroids.

Corticosteroids were a common class of medication for which patients reported new symptoms after starting the medication. While only 40 patients either brought in or knew the exact name of the steroid they were using, an additional 21 patients either (1) knew they were taking a steroid but didn't know the specific name, (2) had documented physical evidence they were likely taking a steroid (ie, developed "moon face" along with other common side effects, such as "fragile" skin after taking the unknown drug chronically), or (3) had a physician's diagnosis stating that the patient was taking chronic steroids. Three excluded patients took NPP steroids before the two-week cutoff and had possible side effects affecting the present diagnosis, ie, "moon face" and possible symptoms of adrenal insufficiency. If these additional patients were included, then 64 (13%) of all 479 patients or 64 (22%) of 288 NPP users, including excluded, had chart evidence of steroid usage.

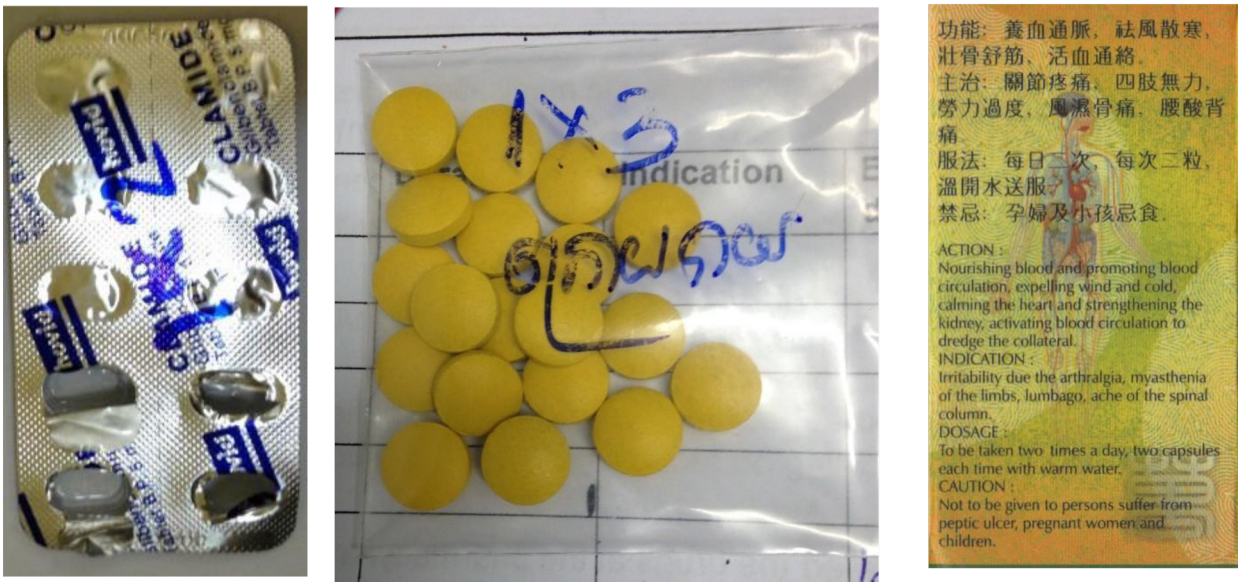

Figure 3. Examples of "written instructions."
Many patients received medication in a plastic bag with simple dosing directions written with a marker on a plastic bag, but usually without the drug name. Occasionally, blister packs were given (name typically in English), with dosing instructions written on the blister pack. Less frequently, a pre-packaged bottle/box was given with instructions typically written in English, French, Thai, or Chinese.

Though formal confirmation of side effects was not possible given the study design, 36 (56%) patients using steroids reported a number of possible side effects, including bilateral femoral head necrosis, poorly controlled or new onset diabetes/hypertension (some showing improvement after stopping the steroid), new epigastric pain with evidence of iron deficiency anemia, (frequently in those also taking an NSAID), skin changes ("fragile" skin, bruising), weight gain, and edema. Additionally, a few patients demonstrated possible, but unconfirmed, signs of adrenal insufficiency after they recently stopped using chronic steroids.

Pain ("total body pain," joint, back, or muscle pain, et.) was the most common hospital presenting complaint for NPP users (40%). It was also the most common reason steroids were prescribed (desired weight gain, respiratory issues, toothache, and rashes were less common reasons). While patients were typically prescribed steroids for only a few days, many with long- term pain returned for more, with 44 (69%) having chart evidence of chronic usage. "Moon face" was a hospital presenting complaint for seven (3%) of our triaged patients, and this side effect was noted by an additional 17 patients.

An unknown intramuscular or intravenous injection was the most common "prescription" therapy received in the two weeks before presentation by 53 patients (24% of NPP users if added to the known prescriptions medication). Eighty-nine NPP users (32%) also admitted to past injection therapy. Only one patient received a subcutaneous injection, possibly insulin, (which may not have necessarily required a prescription in the US.) Only three patients knew the names of their injectable medications (two steroids, vitamin C, and meloxicam). Patients generally bought the medication from one source and then called "someone who knows how to inject" to their home to administer it. Occasionally, a retail seller performed the injection, and a few injections were intra-articular.

The NPPs frequently used glucometers, lab results brought in by patients, and/or blood pressure cuffs to sell antidiabetic and antihypertensive medications, often appropriately when compared to hospital results. However, many patients reported not receiving any information concerning diabetic medication side effects. Of the two diabetic patients who suffered hypoglycemic reactions, neither was aware that eating less might result in hypoglycemia. Of the 30 patients who knew they were diabetic, 26 were taking an anti-diabetic medication, although seven did not know the exact name. Of these diabetic patients, 18 (69%) presented to the hospital with hemoglobin A1C >7 % (for chronic diabetes mellitus) or if newly diagnosed (less than three months) and treated by the NPP, with a serum glucose greater than 200 milligrams per deciliter.

Of the 50 patients who knew they were taking an antihypertensive medication, 17 (34%) reported taking the medications only "when blood pressure was elevated," and 19 (38%) stated they used it "on and off" for symptoms such as "headache and neck tension." One patient thought a short course of medication would cure hypertension.

Antibiotics were frequently prescribed for non-infectious conditions. For example, 16 patients (42%) were prescribed an antibiotic for chronic knee pain. Additionally, many of those

prescribed an antibiotic for an infectious etiology would not have benefited because the disease ultimately diagnosed at the hospital required a different or more complex form of treatment, ie, septic arthritis, tuberculosis, melioidosis, etc.

Examples of specific medication issues in selected patients can be found in **Appendix B**.

DISCUSSION

Though this study has inherent limitations, it does shed light on several issues concerning non-physician prescribed treatment. Many Cambodians lack easy access to physicians, but more than half were able to obtain NPP-prescription medication before presentation to the hospitals. While many non-physician "prescribers" frequently left patients with little information concerning the treatment they had purchased, it is important to note that this study did not compare this practice to physician prescribing; so it cannot be assumed that treatment would have been any different.

We did not specifically count the number of patients given medications without written names; however, many medications were dispensed in this manner (ie, placed in a plastic bag without a name). Without drug names written in the patient's native language or information concerning adverse effects, it becomes difficult for patients to participate in their own healthcare. Many patients are not able to choose commonly used over-the-counter medication on their own simply because they can't read the labels typically written in languages different from their own. It is difficult to identify adverse drug events and even more difficult to prevent future episodes when names are unknown. Failed therapies from the past cannot easily be identified, since once a drug is finished, there is rarely any documentation of the medication prescribed. Verbal information alone may have sufficed in the past when many could not read, but, in our population, more than two thirds of patients were able to read at a basic elementary level and many non-readers have younger family members who could read for them. Written medication information should be provided to all, in their own language, and it is important to emphasize that such information must be saved and brought to subsequent healthcare staff.

Our survey questioned patients about potential medication side effects; however, it would be difficult, considering the study design, to confirm with absolute certainty that the symptoms patients experienced after usage were necessarily caused by the medication. However, a number of patients did report a variety of new symptoms particularly related to chronic steroid usage. While Cambodian physicians at the hospitals are aware that patients may be using chronic steroids and specifically search for symptoms/signs, most patients were completely unaware of steroid risks since this was not communicated to the patient when the medication was sold.

With strong anti-inflammatory effects and rapid improvement of many varied inflammatory symptoms, a number of patients returned for more, some believing, as one patient stated, "steroids cure everything." This belief may be the reason why steroids might be added to traditional Khmer herbal medicines. While we did not conduct chemical analysis on any of the patient's "traditional medications," there is evidence suggesting the practice of mixing prescription medications in herbal concoctions may be more common than recognized. One patient bought an herbal medication from Malaysia that has been banned in the US after a Food and Drug Administration analysis revealed the medication was not purely herbal, but contained steroids and cyproheptadine.[35] Steroid additives to herbal medication have been reported by others in the Southeast Asian region and have resulted in unexpected secondary adrenal insufficiency during stress such as during surgery.[36-38] Two patients who reported *only* using Khmer traditional medication presented with "moon face" after taking the "traditional" medicine chronically, making it highly likely that a corticosteroid was indeed an additive to those Khmer traditional pills. Chinese herbal medications, also used by Cambodians, may also be mixed with steroids, but our study did not independently confirm this.

Knowledge (or lack of knowledge) of chronic steroid use affected the differential diagnosis and management of certain patients with infections. One patient with a long history of steroid use presented with clinical signs of sepsis, progressive fever, shortness of breath, and weakness, and died soon after admission. Although a specific infectious diagnosis was not made, her management and differential were influenced by the knowledge of her chronic steroid usage. Her treatment included stress dose steroids and treatment for possible strongyloidiasis, a common asymptomatic local parasitic infection caused by *Strongyloides* that is known to disseminate when using steroids.[39-40]

Our present study was also not designed to pick up risks from the common practice of injecting medications; however, there has been past evidence of risk. A few years ago, the Ministry of Health actively discouraged this practice after a NPP was discovered to have infected multiple patients with HIV by reusing the same non-sterile needle to inject his patients.[41] Despite the publicity, local doctors state patients still frequently request injections. Injections were found to be the most common type of prescribed medication in this study, yet virtually no one knew the medication that was administered. This is an area that would likely benefit from further studies.

While this study may not be able to generalize the specific findings to other regions of the world, it is likely that many of these same issues can be found in other locales. For example, in addition to issues with steroids/herbal mixtures found in other Southeast Asia locales, a similar problem with injectables occurred recently in India when a NPP also reused needles causing multiple HIV infections.[42]

This study cannot determine the true risk/benefit ratio of NPPs advising patients on medications, because those patients that improved would not likely come to a hospital. A study at the

source of the sale might better characterize the overall risk/benefits of the NPP practice. Additionally, a physician comparison group would further aid in evaluating the risk/benefit.

Non-physicican providers may provide a great benefit to patients, particularly those with chronic diseases, such as hypertension and diabetes, who do not have easy access to a doctor. Though two thirds of our NPP-treated diabetic patients presented with subsequent evidence of poor glucose control, one third demonstrated good control and this may not have been possible without local NPPs. Additionally, having a physician rather than a NPP provide treatment may not necessarily result in better glucose or blood pressure control since poor control may simply reflect the patient's inability to pay for long-term treatment, rather than who advised them. However, one patient, diagnosed with diabetes by a physician, informed the RA that her doctor was insistent she take her medications daily, so she did. She was later diagnosed with hypertension by a NPP but did not receive similar instructions, so only took that medication "on and off." Simply diagnosing a disease and providing a pill may not be enough. The NPPs should have an understanding of the disease for which they are providing medications in order to correctly advise the patient.

Providing more trained medical workers, such as physicians and pharmacists, to help patients gain a greater insight into the medications they have purchased may take years. Stronger governmental oversight or intervention of medication prescribing may take time, too. However, patient education can begin now. Nurse educators could offer general medication sessions including information about medication allergies, common adverse reactions, and information about long-term disease management while patients and families wait at local clinics and hospitals. Basic pre-printed medication information may be useful for both NPPs and patients.

LIMITATIONS

The majority of the data in this convenience sampling of patients was based on patient self-report and may suffer from recall bias. Other study limitations include misinterpretations due to language and cultural differences, small sample sizes, accuracy of medical chart data, and the subjective nature of data analysis. Moreover, selection bias likely occurred as many of the sickest patients were not included in the study. Conversely, many patients prescribed medications by NPPs may never present to a healthcare facility because they improved. This study also lacks a physician comparison group; so the findings may not be representative of NPPs alone. Finally, the study may not be representative of other countries or regions in Cambodia as it was conducted at only two emergency departments in the capitol of Cambodia.

CONCLUSION

Many patients in one low/middle income country received prescription medications from various NPPs with little information concerning these medications and their possible side effects. Education is not only essential, but key to decreasing the risk of iatrogenic disease and helping patients become active participants in their own healthcare.

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Risk Factors for Recurrent Violent Injuries Among African Women in The Gambia

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Introduction: Violence against women remains a major public health concern in African countries. We conducted a matched case-control study to identify risk factors for recurrent violent injuries among African women in The Gambia, a small West African country.

Methods: During the 12-month study period, we recruited study participants from eight emergency departments in the metropolitan areas of the municipality of Kanifing and the West Coast region. We selected women aged ≥15 years who sought medical treatment for an injury due to physical violence at least twice over the study period. Two control groups were used: violence controls (VC), which included those who had experienced a single violence-related injury in the prior 12 months; and nonviolence controls (NVC), which included those who had experienced a nonviolent injury. Control patients were matched based on gender, health facility, injury date, and age (±2 years).

Results: In total, 116 case patients and 232 control patients participated in the study. Results of the conditional logistic regression analyses of the VC and NVC control groups individually showed that women with recurrent violent injuries had a significantly higher likelihood of having a secondary education (odds ratio $[OR]_{VC}$ 6.47; OR_{NVC} 4.22), coming from a polygamous family (OR_{VC} 3.81; OR_{NVC} 3.53), and had been raised by a single parent (OR_{VC} 5.25; OR_{NVC} 5.04). Furthermore, compared with the VC group, women with recurrent violent injuries had a significantly higher likelihood of living in a rented house (OR_{VC} 4.74), living with in-laws (OR_{VC} 5.98), and of having experienced childhood abuse (OR_{VC} 2.48). Compared with the NVC group, women with recurrent violent injuries had a significantly higher likelihood of living in an extended family compound (OR_{VC} 4.77), having more than two female siblings (OR_{VC} 4.07), and having been raised by a relative (OR_{VC} 3.52).

Conclusion: We identified risk factors for recurrent injuries from physical violence among African women in The Gambia. Intervention strategies targeting these risk factors could be effective in preventing recurrent violence against African women. [West J Emerg Med. 2022;23(4)548–556.]

INTRODUCTION

Physical violence among women, which significantly affects their health and well-being, is a major public health concern, and it imposes a huge cost on society.[1,2] Globally, one in three women experiences physical violence requiring emergency department (ED) treatment, and those with prior injury have a high risk of subsequent violent injury and death.[4,5,6] Up to 60% of women in the Unites States treated

in the ED due to physical violence injuries experience recurrent violence, and Black women are approximately three times more likely than White women to become victims of violence.[7,8,9] In the United Kingdom, women account for 80% of ED trauma patients with recurrent physical violence.[10,11]

Studies conducted in North America and Europe have identified several risk factors – sociodemographics, lifestyle choices, and behavior – that are linked to recurrent violence against women,[5,8,12-19] but risk factors for recurrent violence against African women have not been investigated. Furthermore, developed countries differ tremendously from African countries in terms of gender inequality, social cultures and behaviors, and economic aspects; hence, risk factors and their relevant interventions identified in developed countries may not be appropriately generalized to African countries. For example, the predominant sociocultural norms of patriarchy in African societies implicitly promote inequality between men and women and justify violence against women as well as create a social environment conducive to recurrent physical violence against women.[20-22] To prevent the cycle of physical violence among African women, identifying risk factors for recurrent violence specifically in this population is necessary.

We conducted a matched case-control study to identify potential risk factors for recurrent injuries due to physical violence among African women in The Gambia, a small country in West Africa.

Population Health Research Capsule

What do we already know about this issue?
Studies in the US and Europe have identified risk factors for recurrent violence against women, but few have been conducted regarding African women.

What was the research question?
Our goal was to identify risk factors for recurrent injuries due to physical violence among African women in The Gambia.

What was the major finding of the study?
Common risk factors for recurrent violent injuries in African women were having higher levels of education, living in a polygamous family, and being raised by a single parent.

How does this improve population health?
Specific intervention strategies targeting these risk factors could be effective in preventing violence against women in African countries.

METHODS

Study Participants

During the 12-month period October 2016–September 2017, female patients aged ≥15 years who presented to the EDs of eight public healthcare facilities in the metropolitan areas of Kanifing Municipality and the West Coast region of The Gambia were selected to participate in this study: Serrekunda General Hospital; Brikama District Hospital; Faji Kunda (major health center); and Gunjur, Sukuta, Bakau, Banjul'nding, and Serrekunda (with smaller health centers). People living in these metropolitan areas account for about 60% of the country's total population.[23] We excluded private healthcare facilities because they do not offer 24-hour ED services to all patients. Furthermore, the study excluded patients who visited the ED for non-newly incurred injuries (eg, visited the ED a second time for the same violent injury), had difficulty communicating, or could not provide written informed consent.

Women aged ≥15 years who sought medical treatment in the EDs of the 15 healthcare facilities for injuries sustained as a result of physical violence at least twice over the prior 12 months were recruited to the case group. A violent injury was defined as any injury or physical pain that was intentionally inflicted by another person.[3]

We used two separate control groups of patients, one with violence-related and one with nonviolence-related injuries. For each case, two controls were selected, a violence control (VC) cohort that included women aged ≥15 years who had visited the same ED due to a violent injury only once in the prior 12 months, and a nonviolence control (NVC) cohort, which included women aged ≥15 years who visited the same ED due to a nonviolent injury, such as traffic collisions, falls, and sports. Once a case was identified and the patient recruited, two separate controls (VC and NVC controls) were identified and recruited from those who visited the same ED within the next 24 hours. In addition to gender, the two control groups were matched with the index case by the health facility, injury date, and age (±2 years). Matching the health facility and injury date was presumed to exclude potential confounding effects of geographical area and calendar time (weekday, weekend, and holiday). In total, 116 patients were recruited to the case, VC, and NVC groups each.

This research was reviewed and approved by the University of The Gambia Research and Publication Committee and The Gambia Government/Medical Research Council Joint Ethics Committee on Human Subjects' Research. All participants provided written informed consent.

Data Collection

Study variables of interest were obtained through personal interviews by emergency physicians and nurses. Once a case or a control was ascertained, a personal interview

with a structured questionnaire at the ED collected relevant information immediately prior to the violent event with minimal memory lapses and recall errors. We conducted a four-hour training course, including the demonstration and practice of asking questions, probing, and recording responses and interview simulation, to ensure that the physicians and nurses understood the key areas of the structured questionnaire and the interpretation of key variables. To sustain data quality, each study site was regularly visited by two members of our research team (PB and ES) at two-week intervals during the 12-month study period to check for questionnaire completeness.

We collected information on sociodemographics and behavioral and social characteristics. Sociodemographic factors included the following: age; height; weight; gender, ethnicity; educational level; type of family origin: monogamous family (in which a husband lived with one spouse) or polygamous family (a husband living with multiple spouses); marital status; age at first marriage; employment status; household income level; number of households in the compound; numbers of male and female siblings; childhood upbringing; residential status (family house, rented house, or owned house); living with an in-law in the prior 12 months; and body mass index (BMI) (computed as weight in kilograms divided by height squared). Behavioral and social characteristics comprised cigarette smoking, alcohol consumption, illicit drug use in the prior week, witnessing parental violence, having been physically abused as a child, social support, and risk-taking behaviors.

We assessed social support using the Multidimensional Scale of Perceived Social Support (MSPSS).[24] The 12-item MSPSS assesses an individual's perception of support from family, friends, and significant others, with a seven-point rating scale for each item. Summative scores for each source range from 4 to 28, with a higher score indicating stronger social support. The MSPSS has excellent internal reliability (alpha coefficients of 0.91–0.94) and validity in a wide range of African settings.[24, 25]

Risk-taking behaviors were assessed using the revised domain-specific risk-taking scale (DOSPERT). The 30-item DOSPERT evaluates the likelihood that respondents might engage in behaviors from six domains (ethical, gambling, investing, health/safety, recreational, and social), with a seven-point rating scale for each item.[26] A high score for each of the six domains indicates a high risk-taking level. The DOSPERT scale has been used in a wide spectrum of studies examining behavioral risk intentions among different age groups and has exhibited good reliability (alpha coefficients of 0.63–0.75) and validity in the African population.[27]

Statistical Analysis

We compared sociodemographics and behavioral and social characteristics between case and control patients using Pearson's chi-squared test for categorical variables and Student's t-test for continuous variables. In addition, sociodemographics were compared between eligible case patients who did not participate and those who participated in the study.

A conditional logistic regression model was applied to investigate independent relationships of potential risk factors for recurrent violent injuries in which we computed adjusted odds ratios (OR) and their 95% confidence intervals (CI) after adjustment for potential confounding factors. In the initial multivariable analysis, variables with a P-value of <0.25 in the bivariable logistic analysis were included to minimize large type II errors in selection and bias inferences.[28] We employed stepwise selection in the multivariable analysis, and retained variables with a final P-value of <0.05 in the final model. The likelihood ratio and Hosmer-Lemeshow goodness of fit tests were used to evaluate the appropriateness of the model. We performed all data analyses using Statistical Analysis Software version 9.4 (SAS Institute Inc, Cary, NC).

RESULTS

Of 124 women identified to have a recurrent violent injury over the 12-month period, 116 (93.5%) agreed to participate in the study, of whom 96 (83%) had sought treatment more than twice at an ED for a violent injury in the prior 12 months. In addition, 116 patients each were recruited to the two control groups, namely the VC and NVC groups. Table 1 presents the distributions of sociodemographic characteristics of the case group and two control groups. Between the case and VC groups, we observed significant differences in education level, family origin type, living in an extended family compound, and childhood upbringing. Between the case and NVC groups, significant differences were observed in ethnicity, family origin type, educational level, living in an extended family compound, number of female siblings, and childhood upbringing. Between the case and two control groups, no significant differences were observed in age, marital status, age at first marriage, employment status, number of male siblings, and BMI. In addition, the case and VC groups were similar in terms of ethnicity and number of female siblings.

Table 2 presents the distributions of behavioral and social characteristics between the case and two control groups. The case and VC groups were similar in terms of perceived social support from family, friends, and significant others. Between the case and NVC groups, significant differences were observed in perceived social support from family members and friends, and no significant difference was detected in perceived social support from significant others. Furthermore, no significant differences were detected in risk-taking behaviors between the case and two control groups. Table 3 presents the distributions of family factors between the case and VC groups. Between the case and VC groups, a significant difference was detected in residential status, living with in-laws in the prior 12 months, witnessing parental violence, and having been physically abused as a child.

Table 1. Comparisons of sociodemographic factors of the case group with the two control groups.

Characteristics	Cases (N = 116) n (%)	Violence controls (N = 116) n (%)	*P*-value	Nonviolence controls (N = 116) n (%)	*P*-value
Age (years)					
15–24	47 (40.5)	44 (37.9)	0.973	44 (37.9)	1.00
25–34	50 (43.1)	51 (44.0)		51 (44.0)	
35–44	16 (13.8)	18 (15.5)		17 (14.7)	
≥45	3 (2.6)	3 (2.6)		4 (3.5)	
Ethnicity					
Mandinka	36 (31.0)	32 (27.6)	0.090	56 (48.3)	0.06
Wolof	21 (18.1)	37 (31.9)		28 (24.1)	
Fula	24 (20.7)	16 (13.8)		13 (11.2)	
Others[a]	35 (30.2)	31 (26.7)		19 (16.4)	
Educational level					
Primary or no education	25 (21.6)	36 (31.0)	0.032	31 (26.7)	0.01
Secondary education	67 (57.8)	47 (40.5)		43 (37.1)	
Tertiary education	24 (20.7)	33 (28.5)		42 (36.2)	
Type of family origin					
Monogamous	57 (49.1)	91 (78.5)	0.001	86 (74.1)	<0.001
Polygamous	59 (50.9)	25 (21.5)		30 (25.9)	
Marital status					
Married	61 (52.6)	62 (53.4)	0.895	65 (56.0)	0.19
Single	55 (47.4)	54 (46.6)		51 (44.0)	
Age at first marriage					
<18 years	5 (8.2)	9 (14.5)	0.270	3 (5.9)	0.64
≥18 years	56 (91.8)	53 (85.5)		48 (94.1)	
Employment status					
Employed	54 (47.0)	50 (43.4)	0.419	42 (37.5)	0.64
Unemployed	13 (11.3)	3 (17.7)		6 (5.4)	
Home maker	16 (13.9)	30 (16.8)		28 (25.0)	
Student	32 (27.8)	24 (22.1)		36 (32.1)	
Household income[b] (<GMD15,000)	87 (75.0)	96 (82.8)	0.148	92 (82.2)	0.14
Living in an extended family compound	33 (28.5)	13 (11.4)	0.001	10 (4.6)	<0.001
Number of male siblings (>2)	98 (84.5)	95 (81.9)	0.598	62 (53.5)	0.18
Number of female siblings (>2)	102 (87.9)	96 (82.8)	0.265	64 (55.2)	0.02
Raised in childhood					
Both parents	83 (71.6)	104 (89.7)	0.001	103 (93.6)	0.01
Single parent	20 (17.2)	5 (4.3)		5 (4.6)	
Relatives	13 (11.2)	7 (6.0)		2 (1.8)	
Body mass index (kg/m^2), mean ± SD	23.2 ± 5.7	23.7 ± 6.0	0.522	23.9 ± 7.3	0.37

[a]Other ethnic groups include Jola, Serahuli, Manjago, Serer, Aku, and Balanta.
[b]The exchange rate was US dollar 1.0 = GMD 45.0.
GMD, Gambian dalasi; *kg,* kilogram; *m^2,* height squared; *SD,* standard deviation.

Table 4 presents the results of conditional logistic regression analyses obtained using two control groups (VC and NVC) individually for recurrent violent injuries among Gambian women. According to the VC group, participants who attained secondary education had a higher risk of recurrent violent injuries (OR 6.47; 95% CI 2.23-18.84) than those with primary or no formal education. Furthermore, participants belonging to a polygamous family had a higher

Table 2. Comparisons of social characteristics of the case group with two control groups.

Characteristics	Cases (N= 116) n (%)	Violence controls (N=116) n (%)	*P* value	Nonviolence controls (N=116) n (%)	*P* value
Perceived social support, mean ± SD					
Family	22.8 ± 5.7	22.7 ± 5.6	0.88	24.2 ± 4.9	0.04
Friends	22.2 ± 5.4	22.8 ± 5.3	0.39	23.8 ± 4.6	0.09
Significant others	22.7 ± 5.6	22.6 ± 5.8	0.88	22.7 ± 5.3	0.09
Risk-taking behaviors, mean ± SD					
Social	13.6 ± 5.9	13.2 ± 6.3	0.61	13.2 ± 7.6	0.73
Recreational	9.28 ± 5.9	10.1 ± 6.9	0.31	10.8 ± 8.6	0.14
Health and safety	11.3 ± 6.2	11.6 ± 6.8	0.74	11.3 ± 6.2	0.95

SD, standard deviation.

risk of recurrent violent injuries (OR 3.81; 95% CI 1.42-10.26) than those belonging to a monogamous family. Participants raised by a single parent had a higher risk of recurrent violent injuries (OR 5.25; 95% CI 2.08-18.91) than those raised by both parents. Participants living in a rented house had a higher risk of recurrent violent injuries (OR 4.74; 95% CI 1.90-11.81) than those living in a family house. Participants living with in-laws in the prior 12 months (OR 5.98; 95% CI 2.14-16.74) or who had suffered physical abuse as a child (OR 2.48; 95% CI 1.01-6.10) had a higher risk of recurrent violent injuries than did their counterparts.

According to the NVC group, participants with secondary education (OR 4.22; 95% CI 2.67-10.68), from a polygamous family (OR 3.53; 95% CI 1.56-8.00), living in an extended family compound (OR 4.77; 95% CI 2.73-13.17), and having more than two female siblings (OR 4.07; 95% CI 2.81-9.17) had a higher risk of recurrent violent injuries than did their counterparts. Furthermore, participants raised by a single parent (OR 5.04; 95% CI 2.43-17.78) or a relative (OR 3.52; 95% CI 1.00-12.43) had a higher risk of recurrent violent injuries than those raised by both parents.

Table 3. Comparisons of family factors of the case group with the control group, which consisted of women who had experiercned one episode of violent injury in the prior 12 months.

Characteristics	Cases (N=116) n (%)	Violence controls (N=116) n (%)	*P* value
Residential status			
Family house	38 (32.8)	56 (48.3)	<0.001
Own house	9 (7.8)	26 (22.4)	
Rented house	69 (59.5)	34 (14.7)	
Living with in-law in the past 12 months	64 (55.2)	35 (30.2)	<0.001
Witnessing parental violence	71 (61.2)	45 (38.8)	<0.001
Being physically abused as a child	63 (54.3)	28 (24.1)	<0.001

DISCUSSION

Few studies have investigated potential risk factors for recurrent violent injuries among African women as a precursor to providing interventional strategies on violence prevention in the population. The use of two control groups allowed us to validate the result from one group and identify consistent risk factors for recurrent violent injuries. The results of this study indicate that African women have a significantly increased risk of recurrent injuries due to physical violence if they belonged to a polygamous family, attained secondary education, lived in an extended family compound, had more than two female siblings, were raised by a single parent or a relative, lived in a rented house, lived with in-laws in the prior 12 months, and had suffered physical abuse. Furthermore, significant differences were observed in sociodemographic and social characteristics between African women who had suffered recurrent violence and those reporting a single episode of violence within one year.

Contrary to previous findings that physical violence is more prevalent among women with low education,[29,30] our results showed that women in The Gambia who had a secondary education are associated with recurrent injuries from physical violence. One possible explanation is that higher educational attainment of women is an indicator of autonomy and advocation for their rights, which may have resulted in resistance in African society where traditional sociocultural norms propagating gender inequality still exist, thus increasing the risk of recurrent violent injuries.[31] However, women with tertiary education did not exhibit the same result. Another possible explanation for this finding is that less educated women triggered fewer violent confrontations because they tended to be less assertive and more willing to conform to the social expectation that women are to be submissive to their partners.

Table 4. Results of the conditional logistic regression analysis of risk factors with the adjusted odds ratio and 95% confidence interval for comparing the case group with the two control groups.

	Violence controls			Nonviolence controls		
Characteristics	OR	(95% CI)	*P* value	OR	(95% CI)	*P* value
Educational level						
Primary or no education	1.00	reference group		1.00	reference group	
Secondary education	6.47	(2.23–18.8)	<0.001	4.22	(2.67–10.7)	<0.001
Tertiary education	3.11	(0.96–10.1)	0.06	1.36	(0.51–3.67)	0.54
Type of family origin (polygamous/monogamous)	3.81	(1.42–10.3)	0.01	3.53	(1.56–8.00)	<0.001
Living in an extended family compound		N.A.		4.77	(2.73–13.2)	<0.001
Number of female siblings (>2/≤2)		N.A.		4.07	(2.81–9.17)	<0.001
Raised in childhood by						
Both parents	1.00	Reference group		1.00	Reference group	
Single parent	5.25	(2.08–18.9)	0.04	5.04	(2.43–17.8)	0.01
Family relative[a]	1.09	(0.21–3.80)	0.88	3.52	(1.00–12.4)	0.04
Residential status						
Family house	1.00	Reference group				
Own house	0.36	(0.09–1.37)	0.13		N.A.	
Rented house	4.74	(1.90–11.8)	<0.001		N.A.	
Living with in-law in the prior 12 months	5.98	(2.14–16.7)	<0.001		N.A.	
Being physically abused as a child	2.48	(1.01–6.10)	0.05		N.A.	

[a]Relatives include grandparents, aunts, and uncles.
OR, odds ratio; *CI,* confidence interval; *N.A.,* not available.

A polygamous family and living in an extended family compound in Africa partly reflect religious beliefs and traditional family structures in The Gambia. More than 90% of the Gambian population practice Islam and often practice polygamy. Polygamous families have a large family size, which has been strongly associated with violence against women.[32,33,34] In a polygamous family or large extended-family compound, contentious rivalry among co-wives living under one roof is common due to taking turns in cooking, sharing facilities, gossiping, and teasing, as well as other issues related to quarrels between children, which could result in repeated physical confrontations among them or with their male spouse. In addition, because The Gambia is a patriarchal society, this result potentially relates to the importance of social norms around family kinship, such that issues of land use and inheritance by male children cause frequent physical violence among co-wives or with their spouse.

Single-parent families have a high risk of financial hardship and poor parental monitoring.[35] Children who lack adequate parental supervision may be influenced by delinquent peers engaging in risky behaviors and thus increase the risk of recurrent violence in adult life.[36] Furthermore, several studies have indicated that compared with women raised by two biological parents, those raised in single-parent families were more likely to have externalized and internalized disorders, lower social competence, and lifetime exposure to several forms of violence in adult life.[37,38] Alternatively, women pampered by parents are more likely to be violent than their counterparts,[39] and the pampering effect might be stronger in a single-parent family as compensation for the lost time and attention. Studies in the United States and Brazil have revealed that women residing in rented houses experienced five times the physical violence experienced by women living in owned houses.[40,41] The effects of living in rented housing on recurrent violence partly reflects that low- and middle-income families seeking job opportunities but unable to own a house in the metropolitan areas in The Gambia are prone to intra-family violence. Rented houses in The Gambia are often overcrowded and poorly managed, and issues of shared common spaces and household utilities (eg, electricity and water bills) may cause physical confrontation among women. In addition, given that 53% of women in this study were married, the financial stress of meeting daily family needs and paying rent on time might result in displaced aggression and physical confrontations of men with their marital partners.

Similar to the results of studies that were done in the Middle East and South Asia,[42,43] in this study most women with recurrent physical violence lived with their mothers-in-law (51.8%). Several studies have highlighted parents-in-law as instigators of conflict in the couple's relationship and their

role in recurrent violence against women.[12,44] In The Gambia, violence against women might result from the controlling behaviors of mothers-in-law due to overprotectiveness and emotional attachment toward their sons. Furthermore, misunderstandings between daughters-in-law and parents-in-law, such as words or deeds misperceived as disrespect to parents, may have resulted in recurrent violence against women by their partners. Childhood abuse has been associated with numerous adverse adult-health outcomes and has been consistently identified as a strong predictor for physical violence against women.[45,46] Women abused in childhood had an increased probability of internalizing and externalizing behavior problems and risk of incident and recurrent violence in adult life.[47,48]

LIMITATIONS

This study has several limitations. First, although bed partition curtains were closed to prevent potential observation of the participants by unauthorized persons during the interviews and the controls were carefully interviewed to ensure they did not experience multiple violence, it is still possible that some NVC injuries might actually have resulted from violence and some VC injuries might have been recurrent but were not disclosed because the participants were concerned about confidentiality; thus, these potential misclassifications might have led to underestimation of the effects of risk factors identified for recurrent violent injuries. Second, recurrent injuries from physical violence might have been underreported by the two control groups partly because of the fear of negative reactions from the family after disclosing intrafamily violence caused by the spouse or other family members. Third, the generalizability of the results is somewhat limited because only female patients from public health facilities in urban and peri-urban areas were recruited, and those treated in private health facilities or those who live in rural areas might have different risk factors. Fourth, we did not measure alcohol use and substance abuse because the prevalences of the two behavioral characteristics are low in The Gambia, in contrast to high-income western countries where alcohol use and substance abuse are contributing factors to recurrent violent injuries.[6-8] Finally, the characteristics of perpetrators were unmeasured in the study, and their education level, employment status, and alcohol use might have confounded the results.[49]

CONCLUSION

Risk factors for recurrent violence may differ from those for a single episode of violence. African women in The Gambia may be at an increased risk of recurrent injuries if they belong to a polygamous family, have high educational levels, were raised by a single parent, live in a rented house, or live with in-laws. Intervention strategies targeting these factors could be effective for the prevention of violence against African women.

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An Intensive Approach to Improving Diversity, Equity, and Inclusion in an Academic Emergency Department

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A healthcare workforce that demonstrates cultural competence and humility while reflecting the diversity of the surrounding community has the potential to significantly benefit the patient population it serves. In this context and given numerous societal influences and the events of 2020, the leadership of the Department of Emergency Medicine at Albany Medical Center recognized the need to promote diversity, equity, and inclusion (DEI) in multiple areas. These included premedical education, medical education, postgraduate medical education, faculty development, staff satisfaction, and patient care. The department formed a DEI taskforce that developed an ongoing, multipronged, interdisciplinary approach to address these important aspects of our work and clinical environment with the goals of improving staff wellbeing, reducing burnout, and promoting the health of our community. Our experience is shared here to illustrate how a small, dedicated team can implement a variety of DEI initiatives quickly and with relatively little cost at a large academic medical center. [West J Emerg Med. 2022;23(4)557–563.]

INTRODUCTION

A healthcare workforce that demonstrates cultural competence and humility while reflecting the diversity of the surrounding community has long been demonstrated to have significant potential to benefit the patient population it serves.[1,2] Albany Medical Center (AMC) is a private, not-for-profit medical college and academic medical center that has provided medical education and patient care since the 1840s in a city 150 miles north of Manhattan in New York State. The AMC Level I Adult Trauma and Emergency Care Center and Level II Pediatric Emergency Department (ED) see approximately 80,000 patients per year and serve a very large catchment area, incorporating 25 counties in a 150-mile radius with 2.9 million persons in urban, suburban, rural, and austere environments. Because of this large catchment area, AMC is the busiest trauma center in the state.[3]

The patient population is a diverse mix of White (60%), Black or African American (23%), Asian (5%), and Hispanic (5%) populations including a significant proportion (13.2% in 2018) of foreign-born immigrants and refugees from countries in Central America, Africa and Asia, among others. Median household income in the metropolitan census area is $45,500, and 10-20% live below the poverty line (2019 data).[4,5] Department staff include 45 faculty, 36 residents, 24 nurse practitioners and physician assistants (NP/PA), 125 nurses, 55 technicians, and 48 clerical staff in addition to a variable

number of scribes, respiratory therapists, social workers, housekeeping staff, and rotating students. While non-clinical ED staff approximately reflect the surrounding community demographics, the clinical staff are largely White, with only two of the NP/PA group and two faculty identifying as from groups historically underrepresented in medicine (URiM). Staff representation compared to the surrounding population and by role are illustrated in Figures 1 and 2.

The summer of 2020 witnessed an historic shift in how citizens of the United States saw themselves and their neighbors, unfortunately sometimes resulting in animosity and violence. Protests and social justice gatherings roiled the country amid a worldwide pandemic. Throughout the year, AMC saw significant changes in its patient population with increasing volumes of coronavirus disease 2019 (COVID-19) patients in the spring, including dozens transferred to Albany to help decompress an overwhelmed New York City hospital system. Local and regional events in the summer brought an increase in victims of community violence, while overall patient volumes were down as patients stayed home through medical emergencies to try to keep themselves safe.

In this national setting, emotions and tensions within

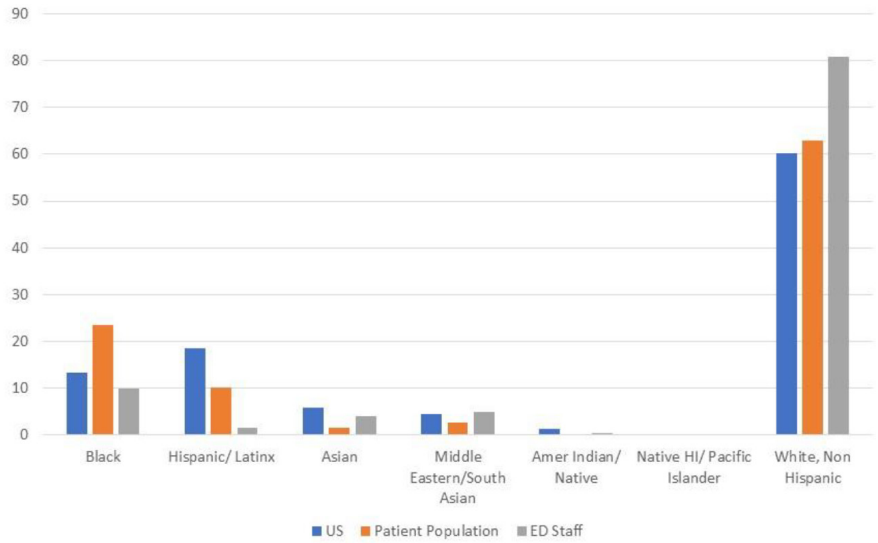

Figure 1. Comparison of population to staff representation by percentage.
HI, Hawaiian; *ED*, emergency department.

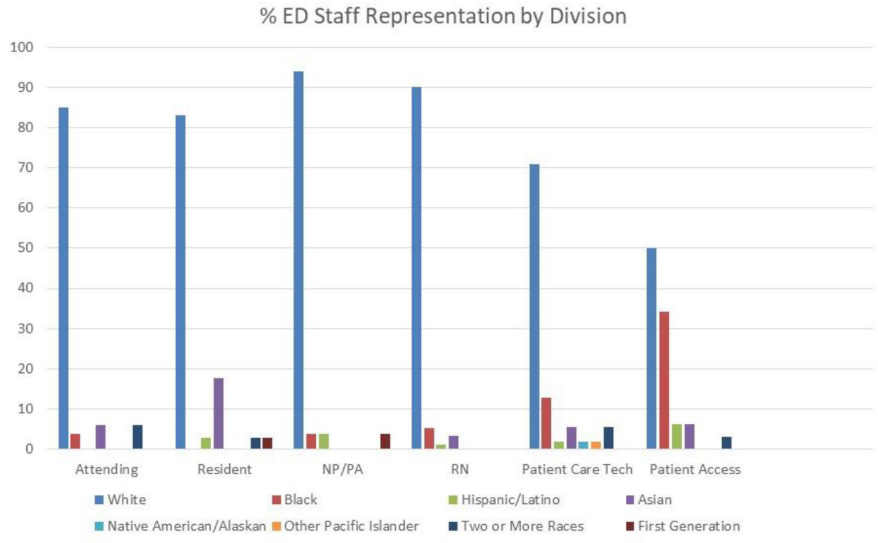

Figure 2. Ethnic/racial make-up of emergency department staff by division at Albany Medical Center.
ED, emergency department; *NP*, nurse practitioner; *PA*, physician assistant; *RN*, registered nurse.

the department were elevated. As a result of conversations between one of the Black medical staff in the department and the chair of the AMC Department of Emergency Medicine (EM), various like-minded staff members gathered to address the topics of diversity, equity, and inclusion (DEI).

MISSION

As a first step, the group identified its mission: to promote an inclusive and equitable environment for all members of the workforce within our emergency department (ED), regardless of gender, race or ethnicity, sexual orientation, title, or position. Furthermore, we strive to provide an environment where our patients feel safe, respected, and understood, regardless of demographics or socioeconomic status; to acknowledge and celebrate patient and staff diversity; to identify and address bias that may exist, both conscious and implicit; and to encourage self-reflection by all members of our workforce.

Stakeholders in this endeavor are led by the department chair, who is an active member of the taskforce and is also involved on a national level as a member of the Association of Academic Chairs of Emergency Medicine Diversity, Equity, and Inclusion Workgroup. The Chief Officer of Diversity and Inclusion for AMC has also been involved, providing input about the overall vision for DEI in the institution and facilitating conversation and collaboration. Active taskforce members include eight faculty physicians, three NP/PAs, two resident physicians, and two patient access representatives (non-clinical support staff). Five members identify as historically URiM. Ad hoc participants in outreach events have included registered nurses, additional patient access staff, medical technicians, respiratory therapists, and emergency medical services personnel. Our most important stakeholders are our patients and the Albany community at large.

GOALS AND OBJECTIVES

In support of this mission, several priorities for our taskforce were established: needs assessment; cultivating an environment of inclusion and representation; promoting individual and collective growth in DEI-related attitudes and skills; recruitment and retention of a diverse workforce; outreach to local middle schools and high schools to establish long-term relationships and encourage interest in health-related professions; and developing relationships with our community to build trust in our healthcare system. These priorities are furthered by the following initiatives (also depicted in Figure 3).

Goal: To examine the current work environment and identify the concerns of department personnel to prioritize areas of focus for improvement efforts.

Initiative 1: Needs Assessment Among Emergency Department Staff

Preliminary informal conversations suggested that staff with a higher proportion of Black, indigenous, and people of color (BIPoC) representation had a high rate of experiencing and witnessing bias, microaggressions, or harassment directed toward themselves or toward patients of certain races or socioeconomic classes, creating tension and an uncomfortable work and patient-care environment. A survey was sent to all staff to further explore these issues, develop a baseline understanding of the ED environment and determine future

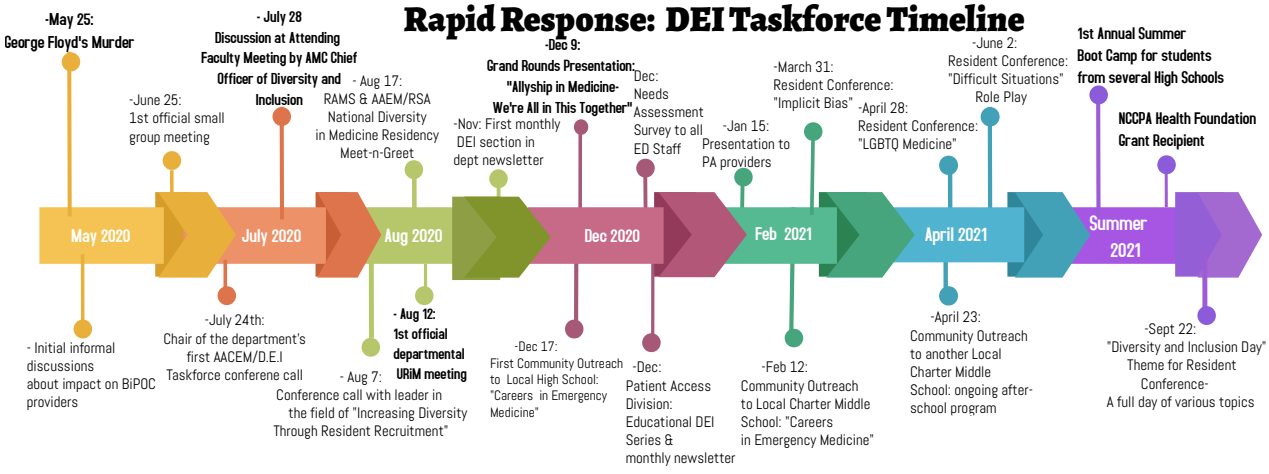

Figure 3. Overview of events sponsored by Albany Medical Center's Diversity, Equity and Inclusion Taskforce (May 2020-September 2022). *DEI*, diversity, equity, and inclusion; *RAMS*, Society for Academic Emergency Medicine Residents and Students; *AAEM/RSA*, American Academy of Emergency Medicine Resident and Student Association; *PA*, physician assistant; *LGBTQ*, lesbian, gay, bisexual, transgender, and queer; *NCCPA*, National Commission on Certification of Physician Assistants; *BIPoC,* Black, indigenous and people of color; *AACEM*, Association of Academic Chairs of Emergency Medicine.

areas of focus. The survey was distributed to all clinical and non-clinical staff whose jobs are primarily based in the ED.

Preliminary review of responses identified several areas of improvement. Overall, most of the respondents felt that their suggestions for improvement are heard and that the department genuinely desires to create a safe and equitable environment. The overwhelming majority agreed with the promotion of DEI as an appropriate goal for the department. Areas of opportunity identified included encouraging interprofessional communica-tion and cultivating an environment of respect toward all staff and patients. These results are being used to help guide efforts for intervention and will be reassessed to monitor progress. The survey also indicated that most staff are interested in learning to recognize bias, address these issues, and improve the work and patient-care environment.

Initiative 2: Use of Resident Survey Data in Program Development

Starting in the 2019-2020 academic year the Accreditation Council for Graduate Medical Education increased its focus on issues of diversity, health equity, and inclusion for residency programs, now including questions relating to these topics on annual trainee and faculty surveys. This initial survey data will provide a baseline and opportunity for ongoing assessment of progress in resident and faculty perception of preparation for interaction with diverse individuals, inclusiveness of the work environment, and program efforts to recruit and retain a diverse workforce as we implement our DEI initiatives. Additionally, an institutional needs assessment headed by the Chief Officer of Health Equity, Diversity and Inclusion was carried out in the summer of 2020, with medical students surveying residents across departments about allyship and previous training received on this topic. The responses revealed a lack of formal training around allyship and a perception of this topic as a significant gap in education.

Goal: To cultivate an environment of inclusion and representation within our department for patients, visitors, and staff.

Initiative 3: Staff Newsletter Diversity Highlights

As part of the goal to promote a culture of inclusivity and maintain healthy relationships between clinicians, the department chair launched a monthly newsletter that highlights achievements of staff members and provides brief educational articles. A section of this newsletter has been dedicated to the DEI taskforce and includes education, links to webinars and presentations, and a calendar that highlights upcoming presentations. In addition, our Patient Access group has started including DEI-related articles in their divisional weekly newsletter.

Goal: To promote individual and collective growth in DEI-related attitudes and skills among staff through education on cultural diversity, discrimination, implicit bias, and social determinants of health.

Initiative 4: Resident and Staff Didactic Curriculum Development

Several new sessions are being incorporated into weekly didactics for the EM residency, with all members of the ED environment, including students and other clinical and non-clinical staff, also invited to participate. Four sessions were developed for the 2020-2021 academic year.

Session 1: "Allyship in Medicine – We Are ALL in This Together"

This first session in the educational series was presented in December 2020 and served as an introductory session to ED staff and students on the DEI taskforce, its mission, basic DEI terminology, and the concept of allyship, which was identified as a curricular need based on previously described needs-assessment data. This one-hour, case-based presentation was developed by a group of medical students and modified for the ED setting by members of the DEI taskforce. It was presented by an interdisciplinary group including students, staff, and the Chief Officer for Diversity and Inclusion. A pre- and post-session survey demonstrated improved understanding of allyship and how to respond to episodes of bias or discrimination witnessed in the clinical and educational environment.

Session 2: Implicit Bias

This one-hour presentation in March 2021 focused on the impact of implicit bias in the clinical and educational environment. It had been previously presented in other departments with positive feedback and generated vigorous discussion on the presence and potential impact of bias.

Session 3: LGBTQ+ Healthcare

This one-hour presentation in April 2021 was based on best current evidence recommendations for healthcare and approach to the lesbian, gay, bisexual, transgender, queer + population, presented by a physician assistant with significant EM and public health experience.

Session 4: Open Forum

In June 2021, this one-hour session consisted of role-play scenarios and provided time for open forum discussion to help solidify some of the information covered in the prior sessions.

Initiative 5: Journal Club

In addition to these didactic sessions, EM journal clubs discussing key articles in DEI-related topics were planned throughout the academic year. Journal club is hosted by the residency program, and all clinical staff are invited.

Goal: To recruit and retain a diverse workforce to fully reflect the community and to improve patient care, education, and the work environment.

Albany Medical College has implemented a deliberate and targeted focus on holistic review of applicants with an emphasis on increasing successful applications for underrepresented minorities, first-generation students and other individuals facing socioeconomic barriers to progress in healthcare education and careers. As a result, the school has seen a significant increase in its URiM matriculants. The Graduate Medical Education Council is assessing institution-wide efforts to increase diversity and inclusion at the postgraduate training level as well. In conjunction with these institutional initiatives, the EM DEI Taskforce has embarked on related efforts in recruitment and retention across all levels of faculty and staff.

Initiative 6: Faculty Recruitment, Retention, and Advancement

As previously noted, current ED staff demographics, particularly clinical staff, do not closely reflect the surrounding community and patient population. Recruitment and retention of healthcare workers outside major metropolitan areas poses unique challenges, and the specific factors impacting URiM faculty are unclear. With the understanding that those who have ties to the area are more likely to stay and invest in the community, we have developed short-, mid- and long-range goals toward developing pipeline relationships with community stakeholders.

We began with a critical assessment of our current faculty and having a frank, transparent discussion on factors that may contribute to lack of diversity. We acknowledge that candidates from all backgrounds need to see themselves and their potential contributions as valued, a "good fit" for the department and community, and with significant potential for growth and advancement. Our short-range goal is to increase awareness among stakeholders, explore barriers to recruitment and retention of traditionally URiM faculty, and take action to reduce those barriers. One issue identified was a lack of mentoring for junior faculty, and a formal mentoring program has been launched to promote faculty development and address impediments such as imposter syndrome.[6]

Mid- and long-range goals are to increase URiM representation in our faculty pipeline including the residency program, scribes, ED techs, and research associates. We hope to make progress in these pipelines through seed programs in local elementary through high schools and reaching out to premed advisors at local colleges to advertise these positions. In addition, the department chair and the chair of our departmental Promotions and Tenure Committee work closely with faculty to identify professional development needs and potential barriers to promotion in order to provide resources to retain faculty and promote success.

Initiative 7: Nurse Practitioner and Physician Assistant Recruiting

As of 2019, less than 10% of PAs practicing in EM identify as URiM.[7] Of our group of 20 full-time and six per diem NP/PAs, 85% are female, one is Black, and one is of Mexican descent. Three of this group are part of the DEI taskforce, and all are encouraged to participate in the various DEI education forums. The director of NP/PA operations, who is Black, has attempted to recruit a more diverse staff by advertising on social media platforms that are directed toward BIPoC, as well as reaching out to PA programs at historically Black colleges and universities (HBCU).

The department has sponsored a Physician Assistant Postgraduate Fellowship since 2010, an intense 12-month long program during which fellows see patients under faculty supervision in the ED and rotate through other services to learn EM-related skills. Approximately 50% of the program graduates have stayed on staff in the department in a full- or part-time capacity. The fellowship co-directors became involved with the DEI taskforce at its inception, with the goal to increase diversity in the program and to contribute to the depart-ment's stated mission of promoting an environment of diversity, equity, and inclusion—for all. Targeted recruiting materials were sent to HBCU PA programs to garner the attention of URiM students to encourage them to consider the field of EM and our program in particular. Openings have also been advertised on various social media BIPoC-centered forums. Efforts to recruit a diverse applicant pool are ongoing, as well as assessment of the effects of these efforts. We are encouraged that for the current academic year, two-thirds of the program participants identify as URiM.

Initiative 8: Resident Recruiting

The residency program director, assistant program directors, and chief residents have participated in DEI taskforce meetings and engaged in open dialogue concerning the current process of resident recruitment and potential ways to help match a more diverse group of students, including but not limited to the areas of race, gender identification and sexual orientation, and first-generation students. Residency leadership invited the input of an outside guest from a residency program that has successfully increased its representation of URiM residents.[8] The residency recruitment process was examined to identify challenges in URiM applications and match rate. Candidate assessment now emphasizes a holistic approach that values overcoming adversity, community involvement/activism, and first-generation status.[6,8]

As part of residency recruiting, taskforce members were involved at all stages, including taking part in interviews, reaching out to URiM applicants after their interviews, participating in virtual "second look" events, and giving input to the candidate ranking process. For the 12 residents matched in 2021, two identify as URiM (previous years ~1/year on average) and three are first-generation college graduates (not previously tracked).

Goal: To increase exposure to careers in medicine for school-age children in underrepresented populations and to establish long-term relationships for pipeline programs.

Initiative 9: "Career Day" in Emergency Medicine

Emergency medicine practice makes evident the importance of increasing diversity in our workforce to promote the health of the diverse population that we serve. Exposure to medicine during early school years can make a significant impact as to whether a student pursues this route later in life.[9] Therefore, a program was initiated to reach out to students at local schools with a high matriculation rate of minority students. Our goal is to provide insight into the many future job opportunities in the ED and healthcare in general.

Members of the DEI taskforce approached representatives from nearby schools to offer sessions intro-ducing students to careers in the ED, with overwhelmingly positive response. Three sessions were held in the 2020-2021 academic year with local high school and middle school students via online platform. Several potential career opportunities were discussed including nursing, physician, NP/PA, respiratory therapy, medical technician, patient access staff, radiology technician, and emergency medical technician. Pathways to these careers were discussed and resources were provided for students interested in further information. Interactive presentation techniques were used, with students asking and answering questions using a polling system. Next steps include incorporating feedback and giving similar presentations at additional schools, and when it is appropriate per public health guidelines we will transition to a combination of in-person workshops and online events.

Initiative 10: High School Student Medical "Boot Camp"

A "boot camp" experience was held in the summer of 2021, comprising a week of in-person programming to introduce high school students to careers in healthcare and get exposure to patient care principles. Students participated in hands-on learning and interactive workshops as well as sessions on career development, building a résumé, and interviewing skills. Students met physicians and staff across a variety of healthcare careers. Our goal through this program was to provide a lasting positive impression of healthcare for the students involved that will lead them to consider a career in medicine. We solicited feedback from participants and received a grant from the National Commission on Certification of Physician Assistants Health Foundation[10] to provide future programming (Figure 3).

Goal: To improve our overall interactions with our diverse patient population, increasing their trust in our department and medical system.

Initiative 11: Sickle Cell Walk/Fundraiser

Sickle cell disease is a condition predominately affecting the BIPoC population with significant individual and community impacts. Despite these significant impacts, sickle cell disease does not get the level of attention or support garnered by some other less common diseases.[11] We think it is important to support research and funding for a disease that significantly impacts our patient population and raise awareness among our staff. The department was a sponsor for an inaugural Sickle Cell Walk fundraiser in 2020, hosted by the Sickle Cell Clinic at the Melodies Center for Childhood Cancer and Blood Disorders at our institution, along with the Underrepresented Student Alliance at Albany Medical College. Our staff raised over $1000 to serve as a sponsor again for the event in 2021 and anticipate that this will be a continuing community partnership moving forward.

Initiative 12: Interactions with Local Educators

A number of local schools serve predominately lower income, BIPoC students, with the largest high school having a racially, ethnically, and culturally diverse population. In addition to direct student interactions described above, educators and staff at these schools have been enthusiastic about interacting with our department, and two taskforce members have been invited to participate in the Business Panel at the urban public high school.

LIMITATIONS

As a preliminary description of a multipronged approach to improvement in DEI in our department, specific outcome measurements are limited at this time. Proposed outcomes include recruitment/retention of faculty, trainees, and staff; retention of current staff; improvement in wellbeing measures; and others to be determined. Our hope is to assess the patient- and community-centered outcomes of these efforts in future papers.

CONCLUSION

It is our hope that through this interdisciplinary, multipronged approach, we will see significant improvements in diversity, equity, and inclusion in our work, clinical, and educational environment. We share these efforts to demonstrate how a small group of motivated individuals can come together as a team to make a potentially large impact for our community at relatively small cost and look forward to continuing to assess and refine this process based on feedback and outcomes.

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Revisits After Emergency Department Discharge for Conditions with High Disposition-Decision Variability at Hospitals with High and Low Discharge Rates

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Introduction: The first proposed emergency care alternative payment model seeks to reduce avoidable admissions from the emergency department (ED), but this initiative may increase risk of adverse events after discharge. Our study objective was to describe variation in ED discharge rates and determine whether higher discharge rates were associated with more ED revisits.

Methods: Using all-payer inpatient and ED administrative data from the California Office of Statewide Health Planning and Development (OSHPD) 2017 database, we performed a retrospective cohort study of hospital-level ED discharge rates and ED revisits using conditions that have been previously described as having variability in discharge rates: abdominal pain; altered mental status; chest pain; chronic obstructive pulmonary disease exacerbation; skin and soft tissue infection; syncope; and urinary tract infection. We categorized hospitals into quartiles for each condition based on a covariate-adjusted discharge rate and compared the rate of ED revisits between hospitals in the highest and lowest quartiles.

Results: We found a greater than 10% difference in the between-quartile median adjusted discharge rate for each condition except for abdominal pain. There was no significant association between adjusted discharge rates and ED revisits. Altered mental status had the highest revisit rate, at 34% for hospitals in the quartile with the lowest and 30% in hospitals with the highest adjusted discharge rate, although this was not statistically significant. Syncope had the lowest rate of revisits at 16% for hospitals in both the lowest and highest adjusted discharge rate quartiles.

Conclusion: Our findings suggest that there may be opportunity to increase ED discharges for certain conditions without resulting in higher rates of ED revisits, which may be a surrogate for adverse events after discharge. [West J Emerg Med. 2022;23(4)564–569.]

INTRODUCTION

The emergency physician's decision to admit a patient is among the most expensive and consequential decisions in healthcare. In 2017, hospital expenditures accounted for nearly a third of the United States' $3.5 trillion in healthcare spending,[1] with the majority of these admissions originating from the emergency department (ED).[2] While critical illness and minor injury carry straightforward disposition decisions, other common

conditions have marked interhospital variability in discharge rates.[3,4] Studies of select populations[5-7] have shown a significant burden of potentially avoidable admissions. Paired with the demonstrated interhospital variability in admission rates, this suggests an opportunity to improve healthcare value by decreasing unnecessary costs associated with avoidable admissions.[8]

To address this opportunity, the American College of Emergency Physicians has proposed an alternative payment model, the Acute Unscheduled Care Model (AUCM), which targets reducing avoidable admissions for conditions with high variability in hospital-level admission rates.[9] This model has been endorsed by the US Secretary for Health and Human Services and is under consideration for implementation by the Center for Medicare & Medicaid Innovation as well as private payers. If adopted, this model would be the first emergency care-based alternative payment model and stands to significantly alter the landscape of value-based payments for emergency care.[9]

Reducing costs is only one component of the value equation, and the AUCM pairs the incentive to reduce admissions with an emphasis on care coordination and adverse event reduction after ED discharge.[9] Little is known, however, about how higher ED discharge rates are associated with post-ED discharge adverse events. One study in Medicare patients found that hospitals with higher ED discharge rates had a threefold increase in mortality rates after ED discharge,[10] while another study of Medicare patients with syncope did not find an association between ED discharge rates and post-discharge adverse events.[3] In addition to suggesting different trends in the association between ED discharge rates and adverse event rates, these studies were limited only to the Medicare population, and to our knowledge this topic has not yet been explored in a more general ED population.

Using conditions that had been previously identified as having high variability in discharge rates,[3,4] our study objective was to describe variation in ED discharge rates and determine whether higher discharge rates were associated with higher rates of ED revisits.

Population Health Research Capsule

What do we already know about this issue?
Interhospital variability in ED discharge rates is significant for certain conditions, and a proposed payment model may incentivize increased discharge rates.

What was the research question?
For conditions with interhospital variability in ED discharge rates, are higher discharge rates associated with more revisits?

What was the major finding of the study?
For many common conditions, EDs with higher rates of discharge were not associated with higher rates of ED revisits.

How does this improve population health?
Our findings suggest that there may be opportunity to increase ED discharges for certain conditions without resulting in higher rates of ED revisits, which may be a surrogate for adverse events after discharge.

METHODS

Study Design and Setting

We performed a retrospective observational analysis of all-payer inpatient and ED administrative data from the California Office of Statewide Health Planning and Development (OSHPD) 2017 database.[11] This database encompasses all non-federal licensed hospitals and EDs in California, which has a large, geographically and sociodemographically diverse population.[12] We used the non-public database for our analysis, which included patient record linkage numbers that allow for tracking ED visits and admissions over time. We accessed the non-public database via an existing data request with the California Department of Health Care Access and Information, which permits nonprofit educational institutions to request and access this data for research purposes. We limited our sample to adult patients (≥18 years old) and excluded EDs with fewer than 10,000 adult patient visits in 2017 to ensure an adequate sample for condition-specific hospital-level analyses. We excluded visits with dispositions of left against medical advice, left before visit completion, other/unknown disposition, and without record linkage numbers because of the inability to precisely classify and measure outcomes for these visits.

We limited our analysis to seven medical conditions that have been previously identified as having interhospital variability in admission rates: abdominal pain; altered mental status; chest pain; chronic obstructive pulmonary disease (COPD) exacerbation; skin and soft tissue infection; syncope; and urinary tract infection.[3,4] We identified these conditions by primary discharge diagnosis using previously described *International Classification of Diseases 10th Revision* and Clinical Classification Software codes.[3,4]

Statistical Analysis

For each condition, we used logistic regression to estimate adjusted discharge rates at the hospital level, adjusting for hospital, age, gender, payer type, and Elixhauser comorbidity score.[13] Using the adjusted mean discharge rates per hospital, we categorized hospitals into quartiles to delineate the hospitals with the highest and lowest rates of adjusted ED discharge for each condition.

Our primary outcome of interest was all-cause ED revisits within 30 days of discharge from an index visit. Index visits were defined as any ED visit for a condition of interest resulting in discharge without a visit for the same diagnosis within the previous 30 days. We limited index visits to the period from January 1–December 1, 2017 to ensure an adequate 30-day follow-up period for assessing ED revisits within the dataset. For each condition, we calculated hospital-level ED revisit rates as the number of index visits that had at least one 30-day ED revisit to any study hospital divided by the total number of index visits. Because timestamps were not available in the dataset, we did not include patients with multiple ED visits on the same day in our revisit count, since we were not able to determine whether the index visit or the other ED visit came first. We compared revisit rates after ED discharge for hospitals in quartiles 1 and 4 using bootstrap-estimated 95% confidence intervals (CI) for each condition. This study was granted human subjects approval through the University of California San Francisco Institutional Review Board.

RESULTS

There were over 12 million visits to 271 EDs resulting in discharge in the calendar year of 2017 in the OSHPD database; the selection of our index visits can be seen in Figure 1. We

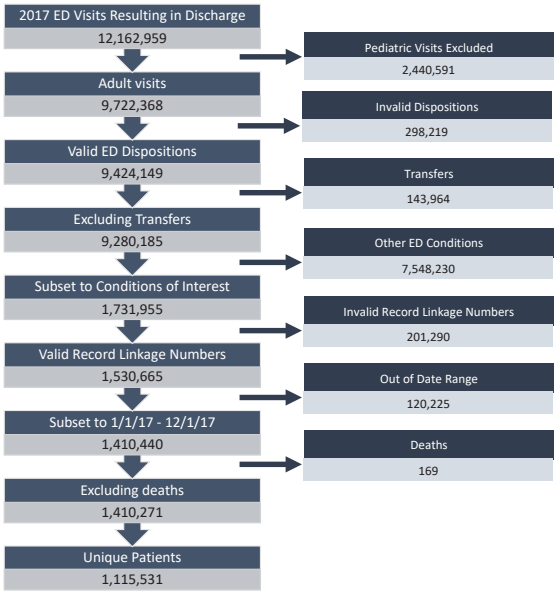

Figure 1. Selection of eligible index visits.

excluded 3.1% of potentially eligible visits due to invalid dispositions. An additional 11.6% of potentially eligible visits were excluded due to lack of record linkage numbers. Ultimately, after exclusions and after subsetting to conditions of interest, we identified 1,410,271 visits resulting in ED discharge by 1,115,531 patients during our study period. Demographic characteristics for these visits can be seen in Table 1.

Table 1. Demographic characteristics of patients discharged from the emergency department with a condition of interest (N = 1,115,531). Missing data: gender (n = 32; 0%); race/ethnicity (n =15,144; 1%); payer (n = 390; 0%).

Characteristic	Frequency	Percentage
Age		
18-34	334,899	30%
35-64	518,717	46%
65-84	208,465	19%
85+	53,450	5%
Gender		
Female	688,913	62%
Male	426,586	38%
Race/ethnicity		
Non-Hispanic White	481,514	43%
Hispanic	361,556	32%
Non-Hispanic Black	125,626	11%
American Indian or Alaska Native	6580	1%
Asian or Pacific Islander	79,626	7%
Other	45,485	4%
Payer		
Private insurance	366,931	33%
Medicare	293,416	26%
Medicaid	376,530	34%
Self pay	60,460	5%
Other	17,804	2%

ED, emergency department.

After adjusting for age, gender, payer, and comorbid conditions, we found a greater than 10% difference in the median ED discharge rates between hospitals in the highest and lowest discharge rate quartiles for every condition of interest except for abdominal pain. The spread of adjusted discharge rates was greatest for altered mental status, COPD exacerbation, and syncope, with a greater than 20% difference in the median adjusted discharge rate at the bottom and top quartiles of hospitals. For each of these conditions, hospitals in quartile 4 discharged greater than 90% of their patients, on average, while hospitals in quartile 1 had adjusted discharge rates around 70% (Table 2). Due to the lack of meaningful variability in interhospital adjusted discharge rates for abdominal pain, we excluded this condition from further analysis.

We next analyzed the differences in ED revisits and found no meaningful difference between the ED revisit rate between hospitals in quartile one, with the highest rate of admissions, and quartile four, with the highest rate of discharges. Among the six conditions with a meaningful difference in ED discharge rates, altered mental status had the highest rate of ED revisits, with a median rate of 34% (95% CI 29-37%) in hospitals with lower discharge rates and 30% (95% CI 28-33%) in hospitals with higher discharge rates. Syncope had the lowest revisit rate, with a median rate of 16% (95% CI 14-18%) in hospitals with lower discharge rates and 16% (95% CI 14-16%) in hospitals with higher discharge rates (Table 3; Figure 2).

DISCUSSION

Our study found that while there was significant variability in ED discharge rates for the majority of conditions studied, higher ED discharge rates were not associated with higher rates of ED revisits. Our results show marked interhospital variation in ED discharge rates, even after adjusting for visit characteristics, for several common conditions; the one studied condition that did not demonstrate this variation had previously been studied in a Medicare rather than all-payer population,[3] and we suspect this may be the reason for our difference in results. Overall,

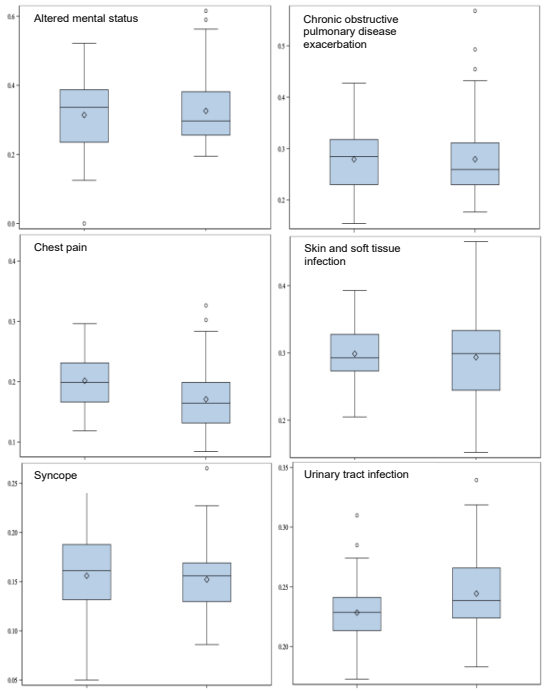

Figure 2. Post-discharge revisits at hospitals with high and low adjusted emergency department discharge rates.
In each panel, left box plot is quartile 1 (more admissions) and right box is quartile 4 (more discharges). Y axis is ED revisit rate.
ED, emergency department.

Table 2. Emergency department adjusted discharge rates, per hospital.

Condition	Quartile 1: median adjusted discharge rate (IQR)	Quartile 4: median adjusted discharge rate (IQR)	Difference in adjusted discharge rate medians between quartiles
Abdominal pain	96% (95-97)	99% (99-99)	3%
Altered mental status	73% (68-79)	96% (94-97)	23%
COPD exacerbation	69% (64-73)	90% (89-94)	21%
Chest pain	83% (74-86)	98% (98-99)	15%
Skin/soft tissue infection	76% (73-78)	91% (90-93)	15%
Syncope	77% (71-82)	98% (97-98)	21%
Urinary tract infection	84% (82-86)	97% (96-97)	13%

COPD, chronic obstructive pulmonary disease; IQR, interquartile range

Table 3. Revisit rate after emergency department discharge for hospitals with the highest and lowest adjusted discharge rate quartiles, reporting the medians and bootstrap estimated 95% confidence intervals. Abdominal pain not included due to lack of variability in discharge rates.

	Median revisit rate (95% CI)	
Condition	Quartile 1 hospitals (Fewer discharges)	Quartile 4 hospitals (More discharges)
Altered mental status	34% (29–37%)	30% (28–33%)
COPD exacerbation	28% (26–29%)	26% (25–29%)
Chest pain	20% (18–22%)	16% (15–18%)
Skin/soft tissue infection	29% (29–30%)	30% (27–31%)
Syncope	16% (14–18%)	16% (14–16%)
Urinary tract infection	23% (22–23%)	24% (23–25%)

CI, confidence intervals; COPD, chronic obstructive pulmonary disease.

this demonstrated variability suggests an opportunity to safely reduce avoidable hospital admissions.

Consistent with previous studies,[3,4] we found that common ED conditions have significant variation in ED discharge rates, and we went on to find that hospitals with higher rates of ED discharge did not have higher rates of revisits. Taken together, our findings suggest a pivotal role of the ED in serving as a gatekeeper for hospital admissions and the associated downstream costs. Prior work has found that EDs serve a critical role in readmission reduction under Medicare's Hospital Readmissions Reduction Program.[14] Our study shows that EDs may have an important upstream role as well in reducing avoidable admissions without placing patients at increased risk of return visits or subsequent admissions.

Reducing avoidable admissions represents a growing area of policy focus with significant implications for healthcare costs. Incentivizing higher rates of ED discharges, however, may place patients at risk for adverse events after ED discharge. While ED revisits are an imperfect marker of ED quality,[15,16] they remain a source of significant expense[17] and may represent patient dissatisfaction with clinical care or the discharge process, or lack of access to outpatient care.[18] To our knowledge, this is the first study to analyze an association between ED discharge rates and revisits in an all-payer population.

Our finding that there was no meaningful difference in revisits after discharge between hospitals that had higher and lower adjusted rates of ED discharge has potential implications for future initiatives aimed at reducing avoidable admissions. Our results suggest that it may be possible to incentivize higher discharge rates without increasing downstream acute care utilization. Further work will be required to assess any association between higher ED discharge rates and other patient-centered outcomes, such as mortality and patient-reported health outcomes and satisfaction. Importantly, one study in Medicare patients did find a higher risk of post-ED discharge mortality for patients seen at hospitals with higher discharge rates.[10] The impact of such initiatives on patient-centered outcomes, especially in high-risk subgroups, will be important to evaluate.

LIMITATIONS

Although the OSHPD database is comprehensive, including nearly all ED encounters in the state of California, our study was limited by the administrative data available as well as the retrospective nature of our analysis. In addition to the limitations below, our analysis was subject to unmeasured confounding. Further, our analysis was limited to one large state, and so our results might not be generalizable to other locations. For example, relative to the United States as a whole, California has a larger Hispanic population, slightly higher poverty rates, and a slightly lower proportion of the population without health insurance.[12]

Our study was also limited to visits with valid record linkage numbers in order to allow for tracking of ED revisits. Visits that were excluded due to lack of record linkage numbers tended to represent younger patients with higher rates of Medicaid or self-pay insurance coverage and could have potentially biased our results in either direction (Supplemental Table 1). Furthermore, records for admitted patients include only the final discharge diagnosis rather than the ED diagnosis. In calculating our ED discharge rates, we used the ED discharge diagnosis for discharged patients while using hospital discharge diagnosis for admitted patients. Therefore, we are likely not capturing some patients who may have been admitted with an ED diagnosis of, for example, "abdominal pain" but were subsequently found to have a definitive diagnosis, which may be listed as their primary hospital discharge diagnosis. This may have resulted in overestimating discharge rates for the symptom-based diagnoses such as chest pain and abdominal pain.

In calculating ED revisits, we were only able to capture 30-day revisits to study hospitals, and it is possible that true revisit rates were higher than presented in our analysis if patients re-presented to EDs that were either not included in the OSHPD database or were excluded from our analysis. This may have biased our results in either direction. Additionally, our model only included adjustment for patient characteristics, and we did not control for hospital or geographic characteristics. While this is consistent with models currently in use by the Centers for Medicare & Medicaid Services,[19] it is possible that hospital-level factors accounted for some of the variability we saw in adjusted discharge rates. Previous work has demonstrated that variability in ED admission rates does persist, however, even after adjusting for hospital-level factors.[4,20]

CONCLUSION

Our study did not find a relationship between higher ED discharge rates and ED revisits, which may suggest that ED discharges may be able to be safely incentivized for certain conditions without increasing the risk of ED revisits. However, further work is needed to determine whether this pattern can be demonstrated for other conditions and for other post-discharge adverse events. It will also be essential to determine the impact of specific ED interventions, such as ED observation or case management involvement, on post-discharge adverse events. As private and public insurers continue to consider alternative payment models focused on reducing avoidable admissions, it will be critical to prospectively assess the impact on patient safety, especially in high-risk populations.

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Predictors of COVID-19 Vaccination Among EMS Personnel

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Introduction: Unvaccinated emergency medical services (EMS) personnel are at increased risk of contracting coronavirus disease 2019 (COVID-19) and potentially transmitting the virus to their families, coworkers, and patients. Effective vaccines for the severe acute respiratory syndrome coronavirus 2 virus exist; however, vaccination rates among EMS professionals remain largely unknown. Consequently, we sought to document vaccination rates of EMS professionals and identify predictors of vaccination uptake.

Methods: We conducted a cross-sectional survey of North Carolina EMS professionals after the COVID-19 vaccines were widely available. The survey assessed vaccination status as well as beliefs regarding COVID-19 illness and vaccine effectiveness. Prediction of vaccine uptake was modeled using logistic regression.

Results: A total of 860 EMS professionals completed the survey, of whom 74.7% reported receiving the COVID-19 vaccination. Most respondents believed that COVID-19 is a serious threat to the population, that they are personally at higher risk of infection, that vaccine side effects are outweighed by illness prevention, and the vaccine is safe and effective. Despite this, only 18.7% supported mandatory vaccination for EMS professionals. Statistically significant differences were observed between the vaccinated and unvaccinated groups regarding vaccine safety and effectiveness, recall of employer vaccine recommendation, perceived risk of infection, degree of threat to the population, and trust in government to take actions to limit the spread of disease. Unvaccinated respondents cited reasons such as belief in personal health and natural immunity as protectors against infection, concerns about vaccine safety and effectiveness, inadequate vaccine knowledge, and lack of an employer mandate for declining the vaccine. Predictors of vaccination included belief in vaccine safety (odds ratio [OR] 5.5, P=<0.001) and effectiveness (OR 4.6, P=<0.001); importance of vaccination to protect patients (OR 15.5, P=<0.001); perceived personal risk of infection (OR 1.8, P=0.04); previous receipt of influenza vaccine (OR 2.5, P=0.003); and sufficient knowledge to make an informed decision about vaccination (OR 2.4, P=0.024).

Conclusion: In this survey of EMS professionals, over a quarter remained unvaccinated for COVID-19. Given the identified predictors of vaccine acceptance, EMS systems should focus on countering misinformation through employee educational campaigns as well as on developing policies regarding workforce immunization requirements. [West J Emerg Med. 2022;23(4)570–578.]

INTRODUCTION

As of August 2021, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for coronavirus disease 2019 (COVID-19), has infected more than 40 million Americans and is responsible for 649,299 deaths.[1] The disease was classified by the World Health Organization (WHO) as a pandemic in March 2020, with more than 216 million cases and 4.5 million deaths reported globally as of August 2021.[2] Among US healthcare workers (HCW) specifically, the Centers for Disease Control and Prevention (CDC) has reported 548,367 cases of COVID-19 and 1747 deaths.[3]

Due to frequent interactions with potentially infected patients, combined with the shortage of personal protective equipment at the time this study was conducted, emergency medical services (EMS) professionals are at particular risk of contracting as well as disseminating COVID-19. Besides their individual risk of acquiring COVID-19 in the workplace, EMS professionals may act as a vector and transmit the disease to susceptible patients, coworkers, friends, and family. For this reason, it is essential that all EMS professionals be vaccinated against COVID-19.

At the time this study was conducted, two mRNA vaccines received emergency use authorization (EUA) by the Food and Drug Administration (FDA) in December 2020, which demonstrated 94% and 95% efficacy against symptomatic COVID-19 in clinical trials among the general population.[4,5] With respect to HCWs specifically, several studies demonstrated that vaccinating employees substantially reduced illness. Notably, Swift et al reported 78% and 96% vaccine effectiveness (VE) among 3210 partially and 44,011 fully vaccinated Mayo Clinic employees.[6] Similarly, in a large-scale study of 23,324 HCWs in England, Hall et al realized a VE of 70% and 85% among partially and fully vaccinated employees, respectively.[7]

In addition to the mRNA vaccines, a viral vector vaccine was also granted EUA status February 27, 2021. The mRNA vaccines required a staggered two-injection process to achieve the most optimal results. While the single-dose viral vector vaccine did not offer the same protection against morbidity (66.3% in clinical trials),[8] it did offer similar protection against mortality. Furthermore, the international Phase 3 data reported the vaccine was 85% effective in preventing severe cases of COVID-19. Of the 19,630 individuals who received the actual vaccine, there were three deaths reported, none related to either COVID-19 or the vaccine. Thus, the viral vector vaccine was deemed 100% effective in preventing COVID-19-related deaths in the study group.

Despite the protective benefits of vaccination, substantial vaccine hesitancy and resistance exists among the US general population, with 18% indicating that they are unlikely to accept the COVID-19 vaccine specifically.[9] More importantly, overall vaccine hesitancy observed in the general population has been linked to the level of hesitancy among HCWs in general.[10] To date, only two studies have explicitly addressed COVID-19 vaccine hesitancy and immunization rates of EMS personnel. In a cross-sectional survey of US firefighters and EMS personnel, Caban-Martinez et al reported that over half of their respondents were either uncertain or unlikely to receive the vaccine.[11] However, this study was conducted prior to any issued EUA or formal vaccine approval by the FDA. A similar cross-sectional study conducted in Germany found a slightly higher willingness to receive the vaccine (57%), but this study was also conducted prior to widespread vaccine availability.[12] Moreover, it is unclear whether these findings could be extrapolated to US EMS personnel.

Given the lack of investigations of vaccine receptiveness of US EMS professionals in a post-vaccine era of COVID-19, we sought to document vaccination rates in a single state and identify predictors of vaccination uptake.

Population Health Research Capsule

What do we already know about this issue?
Unvaccinated EMS personnel are at increased risk of contracting and transmitting COVID-19.

What was the research question?
What is the vaccination rate of EMS professionals and what are the predictors of vaccination uptake?

What was the major finding of the study?
Nearly 25% of EMS personnel are unvaccinated against COVID-19, with contrasting opinions regarding vaccine safety and effectiveness.

How does this improve population health?
Our results suggest EMS systems should focus on countering misinformation through employee educational campaigns and developing policies regarding workforce immunization requirements.

METHODS

Human Subject Review

Institutional review board approval for this study was obtained from Wake Technical Community College Department of Emergency Medical Science, and electronic informed consent was obtained from each respondent at the start of the survey.

Instrument and Setting

We conducted a cross-sectional survey from April 27–May 18, 2021 to assess the attitudes, beliefs, and COVID-19 vaccination status of EMS personnel. Also included in the survey were illness profiles regarding COVID-19 illness

and immunization for family, friends, coworkers, and the individual respondent. A unique, online survey was developed using constructs similar to the health belief model.[13] Briefly, the health belief model posits that an individual's assessment of their personal risk of illness, combined with their belief in the effectiveness of the recommended health behavior (eg, vaccination), predicts the likelihood of adopting the recommended behavior. Guided by these constructs, we designed the survey and then piloted it on a small group of EMS professionals. Based on the responses to the pilot, the survey was revised for clarity. The final survey consisted of 53 items and was designed to be completed within 10 minutes.

Links to the web-based survey (Qualtrics, Provo, UT) were emailed to EMS personnel listed as actively credentialed by the North Carolina Office of EMS via their data management vendor. Emergency medical technicians (EMT), advanced EMTs, and paramedic field professionals were invited to complete the survey. Due to variable and sometimes infrequent EMS responses and patient exposures, first responders certified at the emergency medical responder level were excluded from the survey. Participation was anonymous and voluntary, and no inducements to participate were provided.

Statistical Methods

All data was exported from the Qualtrics web survey platform into a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA) and later imported into SPSS version 27 (IBM Corp., Armonk, NY) for analysis. All statistical analyses were two-tailed with statistical significance established at $P=\leq 0.05$.

Standard descriptive statistics were computed, and univariate comparisons for categorical variables were conducted using the chi square test, Fisher's exact test, or Yate's continuity correction as appropriate. We developed a multivariable binary logistic regression model to identify independent factors associated with uptake of the COVID-19 vaccine. All variables were entered into the model, and backward stepwise elimination was used to remove non-significant variables based on likelihood ratios. To evaluate model performance, we computed area under the curve of the receiver operating characteristic (AUC-ROC) for the final model.

RESULTS

A total of 860 EMS professionals completed the survey in its entirety. Demographic and employment characteristics of respondents are shown in Table 1. The majority of respondents were male (66.5%), White (93.3%), paramedic credentialed (66.4%), employed full-time (78.3%), and held a college degree (64.1%). The average age of the respondents was 41.1 (± 12.4) years with a mean of 15.3 (±10.9) years of EMS experience. Of all respondents, only 582 (67.7%) had received the influenza vaccine during the 2020-2021 season, demonstrating some degree of underlying vaccine hesitancy in this sample.

Table 1. Sociodemographic characteristics of respondents.

Parameter	N = 860 n (%)
COVID-19 Vaccination Status	
Have received or plan to receive	642 (74.7%)
Do not plan to receive	218 (25.3%)
Age (mean [SD])	41.1 (12.4)
Male Gender	572 (66.5%)
Race	
White	802 (93.3%)
Black	16 (1.9%)
Multi-racial	26 (3.0%)
Native American	10 (1.2%)
Asian American or Pacific Islander	6 (0.7%)
Hispanic Origin	28 (3.3%)
Employed fulltime	673 (78.3%)
Level of EMS certification	
EMT	224 (26.0%)
Advanced EMT	65 (7.6%)
Paramedic	571 (66.4%)
Years of EMS experience (mean [SD])	15.3 (10.9)
Highest level of education in any field	
High school	45 (5.2%)
Some college	264 (30.7%)
AAS degree	243 (28.3%)
Bachelor's degree	222 (25.8%)
Master's degree	77 (9.0%)
Doctoral degree	9 (1.0%)

COVID-19, coronavirus disease of 2019; *SD,* standard deviation; *EMS,* emergency medical service; *EMT,* emergency medical technician; *AAS,* associate of applied science.

Regarding the COVID-19 vaccine, 642 (74.7%) had already received or planned to soon receive the vaccine. The individual, familial, and coworker COVID-19 disease burden was extensive. A small yet significant portion of the sample (17.7%) had been previously infected, 23.4% lived in the same household as someone with a previous diagnosis, and over half (54.3%) had family members living outside the home with a prior occurrence of COVID-19 illness (Table 2). The vast majority (95.7%) knew at least one EMS coworker previously diagnosed with COVID-19.

In general, survey respondents reported that they believed the following: they are at higher risk for COVID-19 than the general population (67.1%); COVID-19 is a moderate to severe threat to the US population (68.7%); they had received enough information to make an informed decision about being immunized against COVID-19 (87.7%); the risk of side effects from the COVID-19 vaccines is outweighed by the prevention of the disease in the general public (71.7%); the vaccines are

Table 2. Differences between vaccinated and unvaccinated respondents.

Respondent Characteristic	All respondents N (%)	Unvaccinated N (%)	Vaccinated N (%)	P-value
Received influenza vaccine for 2020-2021 season	582 (67.7%)	67 (30.7%)	515 (80.2%)	<0.001
Previously diagnosed with COVID-19	152 (17.7%)	52 (23.9%)	100 (15.6%)	<0.008
Someone in same household previously diagnosed with COVID-19	201 (23.4%)	67 (30.7%)	134 (20.9%)	<0.004
Family member(s) living outside respondent's household previously diagnosed with COVID-19	467 (54.3%)	124 (56.9%)	343 (53.4%)	0.420
Friend(s) previously diagnosed with COVID-19	726 (84.4%)	179 (82.1%)	547 (85.2%)	0.327
Coworker(s) previously diagnosed with COVID-19	823 (95.7%)	207 (95.0%)	616 (96.0%)	0.665
Has cared for anyone ill with COVID-19 while performing duties as an EMS professional	782 (90.9%)	206 (94.5%)	576 (89.7%)	0.047
Feel my level of risk is higher than the general population for getting COVID-19	577 (67.1%)	85 (39.0%)	492 (76.6%)	<0.001
Agree the COVID-19 vaccine is somewhat or very effective	654 (76.0%)	43 (19.7%)	611 (95.2%)	<0.001
Agree the COVID-19 vaccine is somewhat or very safe	663 (77.1%)	48 (22.0%)	615 (95.8%)	<0.001
Agree or strongly agree it is important for healthcare workers to receive the COVID-19 vaccine to protect themselves	618 (71.9%)	23 (10.6%)	595 (92.7%)	<0.001
Agree or strongly agree it is important for healthcare workers to receive the COVID-19 vaccine to protect their patients	611 (71.0%)	20 (9.2%)	591 (92.1%)	<0.001
Received training or education material from employer on the COVID-19 vaccine or COVID-19 illness	726 (84.4%)	184 (84.4%)	542 (84.4%)	0.285
Recall of employer recommending COVID-19 vaccine	659 (76.6%)	129 (59.2%)	530 (82.6%)	<0.001
Wears a mask in the ambulance when not transporting a patient	376 (43.7%)	84 (38.5%)	292 (45.5%)	0.125
Wears a mask at the ambulance base between calls	253 (29.4%)	38 (17.4 %)	215 (33.5%)	<0.001
Socially distances at the ambulance base between calls	419 (48.7%)	66 (30.3%)	353 (55.0%)	<0.001
Wears a mask in public while off-duty	632 (73.5%)	89 (40.8%)	543 (84.6%)	<0.001
Socially distances in public while off-duty	644 (74.9%)	100 (45.9%)	544 (84.7%)	<0.001
Received enough information to make an informed decision about being immunized against COVID-19	754 (87.7%)	171 (78.4%)	583 (90.8%)	<0.001
Would be comfortable if a member of my family were being treated in a healthcare facility by healthcare workers unvaccinated against COVID-19	574 (66.7%)	210 (96.3%)	364 (56.7%)	<0.001
Would be comfortable if a member of my family were being transported by ambulance and cared for by EMS professionals who have not been vaccinated against COVID-19	583 (67.8%)	211 (96.8%)	372 (57.9%)	<0.001
Has previously reported to work despite experiencing cold or flu-like symptoms or those symptoms that could be precursors to COVID-19	224 (26.0%)	59 (27.1%)	165 (25.7%)	0.759
Agree or strongly agree the risk of side effects from the COVID-19 vaccine is outweighed by the prevention of the disease in the general public	617 (71.7%)	74 (33.9%)	543 (84.6%)	<0.001
Believes that COVID-19 is a moderate to severe threat to the US population as a whole	591 (68.7%)	53 (24.3%)	538 (83.8%)	<0.001
Trusts state government to take the appropriate actions to reduce the spread of COVID-19	360 (41.9%)	18 (8.3%)	342 (53.3%)	<0.001
Believe my state government should prioritize reducing the spread of COVID-19 over individual objections to mask mandates	470 (54.7%)	33 (15.1%)	437 (68.1%)	<0.001
Believes the COVID-19 vaccine				
Should not be mandatory for all EMS workers	405 (47.1%)	206 (94.5%)	199 (31.0%)	
Should be mandatory for all EMS workers, but with option to decline	294 (34.2%)	12 (5.5%)	282 (43.9%)	<0.001
Should be mandatory for all EMS workers	161 (18.7%)	0 (0.0%)	161 (25.1%)	

COVID-19, coronavirus disease of 2019; *EMS,* emergency medical services;

Table 3. Primary reason why respondents did not receive COVID-19 vaccination

Reason	N (%)
I am concerned about the safety of the vaccine.	79 (36.2%)
I don't think the COVID-19 vaccine is effective.	16 (7.3%)
I have not received enough information about the COVID-19 vaccine to make a decision.	14 (6.4%)
I am worried about the side effects of the COVID-19 vaccine.	12 (5.5%)
I'm healthy and don't worry about getting COVID-19.	11 (5.0%)
I have had COVID-19 and don't think I will get COVID-19 again.	11 (5.0%)
I don't consider COVID-19 to be a serious illness.	9 (4.1%)
My natural immune system will protect me.	7 (3.2%)
It is not required by my employer.	7 (3.2%)
I don't consider myself to be in a targeted group for which immunization is recommended.	4 (1.8%)
Religious reasons	4 (1.8%)
I am generally against vaccines.	2 (0.9%)
I believe the flu vaccine gave me the flu and I fear the COVID-19 vaccine may give me COVID-19.	1 (0.5%)
I have had a flu vaccine before and got sick anyway and would expect the same from the COVID-19 vaccine.	1 (0.5%)
I am allergic to the vaccine.	1 (0.5%)
Other	39 (17.9%)

COVID-19, coronavirus disease of 2019.

somewhat or very safe (77.1%) and effective (76.0%); it is important for HCWs to receive a COVID-19 vaccine to protect themselves (71.9%) and their patients (71.0%); and recalled their employer recommending a COVID-19 vaccine (76.6%). For each of these attitudes and beliefs, a univariate analysis observed significant differences between vaccinated and unvaccinated respondents (Table 2). In addition, respondents who received a seasonal influenza vaccination were also more receptive to vaccination for COVID-19 (80.2% vs 30.7%, P=<0.001).

Despite overall favorable opinions regarding vaccine safety and effectiveness, only 18.7% believed the COVID-19 vaccine should be mandatory for all EMS professionals, with most believing it should be optional (47.1%) or mandatory with the option to decline (34.2%), similar to the hepatitis B vaccination. Furthermore, respondents indicated a low level of trust in state government to take appropriate actions to reduce disease spread (41.9%) and opposition to any government actions that superseded individual objections to donning face masks while in public (45.3%).

Despite their belief that they were at greater risk of contracting COVID-19, few (43.7%) reported wearing a mask in the ambulance when not transporting a patient, or masking (29.4%) or practicing physical distancing (48.7%) while at the ambulance base. The lack of these risk-averting behaviors extended into public settings while off-duty, particularly among the unvaccinated (Table 2). The unvaccinated were also more comfortable with a member of their family being treated in a healthcare facility by unvaccinated HCWs (96.3%) or being treated and transported by unvaccinated EMS professionals (96.8%) compared to their vaccinated counterparts (66.7% and 67.8%, respectively).

The top reasons cited by respondents who did not receive one of the COVID-19 vaccines included concerns about safety and effectiveness, inadequate information to make an informed decision, concerns about vaccine side effects, reliance on the protective properties of personal health or natural immune response, and previous COVID-19 illness (Table 3). Of these, concern about vaccine safety was by far the most frequently cited reason for not accepting the vaccine (36.2%). For those respondents who did receive a COVID-19 vaccine, the most cited reasons for doing so included the desire to protect themselves, their families, and their patients; belief of increased work-related risk; seriousness of the disease; and the perception that benefits to vaccination outweighed the risks (Table 4).

Logistic regression odds ratios (OR), 95% confidence intervals (CI), and P-values for the prediction of vaccination uptake are shown in Table 5. The model adequately predicted COVID-19 vaccination uptake with an AUC-ROC of 0.96.

Table 4. Reasons why respondents accepted COVID-19 vaccine

Reason	N (%)
Being vaccinated protects my family.	79 (36.2%)
I feel I am at risk for COVID-19 because of my work.	16 (7.3%)
I think it protects me from getting COVID-19.	14 (6.4%)
COVID-19 is a serious disease.	12 (5.5%)
I don't want to expose my family to COVID-19 should I become infected at work.	11 (5.0%)
The benefits of the COVID-19 vaccine outweigh the risk of any side effects.	11 (5.0%)
Being vaccinated protects my patients.	9 (4.1%)
I work with patients at risk of complications from COVID-19, and I don't want to expose them to COVID-19.	7 (3.2%)
My employer provides free COVID-19 vaccination.	7 (3.2%)
I will miss fewer days of work due to illness.	4 (1.8%)
I've had the flu in the past and don't want to experience COVID-19.	4 (1.8%)
I was encouraged by my personal physician.	2 (0.9%)
I have a health condition (eg, heart disease, pulmonary disease) that might be exacerbated if I got COVID-19.	1 (0.5%)
I was encouraged by my coworkers.	1 (0.5%)
Other	1 (0.5%)

COVID-19, coronavirus disease of 2019

Table 5. Logistic regression model results for prediction of COVID-19 vaccination.

Parameter	Estimate (B)	Odds ratio (95% CI)	P value
Did you receive the influenza vaccine during last year's influenza season? (reference category = "no")	0.946	2.57 (1.37-4.81)	0.003
Previously diagnosed with COVID (reference category = "no")	-0.648	0.52 (0.25-1.08)	0.081
Perception of greater risk of COVID infection compared to general population (reference category = "perceived risk less than or equal to general population")	0.626	1.87 (1.01-3.46)	0.047
Positive belief in effectiveness of vaccine (reference category = "not at all effective or not very effective")	1.534	4.63 (2.20-9.76)	< 0.001
Positive belief in safety of vaccine (reference category = "not at all safe" or "not very safe")	1.715	5.55 (2.61-11.79)	< 0.001
Positive belief in importance of healthcare workers to receive the COVID-19 vaccine to protect their patients. (reference category = "strongly disagree" or "disagree")	2.746	15.58 (7.74-31.33)	< 0.001
Have you received enough information to make an informed decision about being immunized against COVID-19? (reference category = "no")	0.903	2.46 (1.12-5.39)	0.024

COVID-19, coronavirus disease of 2019.

Overall prediction accuracy of the model was 92.8% with a Hosmer and Lemeshow goodness of fit test ($\chi 2$ 2.44, P=0.78), and Nagelkerke R^2 0.789. The factors retained in the final model included "previous receipt of influenza vaccine" (OR 2.57, P=0.003); "previously diagnosed with COVID" (OR 0.52, P=0.08); "perception of greater risk of COVID infection compared to general population" (OR 1.87, P 0.04); "positive belief in effectiveness of vaccine" (OR 4.63, P=<0.001); "positive belief in safety of vaccine" (OR 5.55 , P=<0.001); "positive belief in importance of healthcare workers to receive the COVID-19 vaccine to protect their patients (OR 15.58, P =<0.001); and "received enough information to make an informed decision about being immunized against COVID-19" (OR 2.46, P=0.02).

DISCUSSION

In 2019 the WHO listed 10 threats to global health; among these were vaccine hesitancy and a global pandemic.[14] Alas, the world is now confronting both threats simultaneously. The rationale among the non-vaccinated is complicated, but misconceptions prevail regarding the safety and effectiveness of vaccines in general, and the COVID-19 vaccines specifically. The resulting suboptimal uptake of a safe and effective vaccine for an easily transmissible and potentially lethal infection has been christened the "pandemic public health paradox."[15] Unfortunately, HCWs, including EMS personnel, are not immune to the misinformation energizing vaccine hesitancy.

In our cross-sectional survey, we found a COVID-19 vaccination rate among EMS professionals in North Carolina of 74.7%, which is 55% higher than the national vaccination intention rate among US firefighters and EMS workers previously reported by Caban-Martinez et al.[11] This proportion is also substantially greater than the previously reported influenza vaccination rates of North Carolina EMS professionals.[16] Despite this, a substantial segment of the EMS workforce, their patients, families, and other contacts are still at considerable risk. The majority of survey respondents believed that COVID-19 posed a serious threat to public health, that they were at increased risk of work-related infection, and that the COVID-19 vaccines were safe and effective. However, these beliefs alone did not ensure a higher vaccination rate, and the contrasting opinions and beliefs between the vaccinated and unvaccinated were striking.

Among respondents, the reasons for receiving the COVID-19 vaccination were similar to results reported by Maltezou et al and included the motivation to protect themselves, their families, and their patients, as well as a desire to control the continued spread of a serious disease.[17] Reasons for not receiving one of the vaccines included concerns about vaccine safety and effectiveness, insufficient knowledge of the vaccine, concerns with respect to side effects, prior COVID-19 infection, and reliance on personal health and natural immune response to combat any potential coronavirus disease. Similarly, Schrading et al also reported concerns about vaccine safety and effectiveness, side effects, and previous COVID-19 diagnosis as reasons for declining vaccination among a survey of US emergency department personnel.[18] These concerns were echoed in a survey of HCWs at a large university healthcare system.[19] Additional concerns cited by this healthcare system cohort included political involvement, vaccine research methodology, EUA (ie, a lack of full FDA approval), and the novelty of the vaccine.[19]

Our statewide survey was conducted during the period between the initial surge and the subsequent delta variant-fueled wave of the COVID-19 pandemic. During the data collection period, a statewide mandate for face coverings and social distancing in public settings was in place and daily infections were declining. There were 518–1988

daily cases reported in North Carolina during this time, and the cumulative COVID-19 cases ranged from 966,878 to 991,376.[20] By the end of the survey, roughly 9.3% of the general population in the state had been diagnosed with COVID-19 compared to the 17.7% in our sample, highlighting the increased disease burden among EMS professionals. Whether this excess case rate was the result of true illness from work-related or off-duty exposures or a reflection of increased access to testing remains unknown. In addition to their own illness, most of the respondents reported either living in the same household as someone with a previous COVID-19 diagnosis (23.4%) or having family members living outside the home who had a similar diagnosis (54.3%).

In addition to some degree of vaccine hesitancy, our respondents also reported personal behaviors representing missed opportunities to reduce work-related disease transmission, such as wearing masks and physically distancing when possible while not actively engaged in patient care activities during their duty shift. These on-duty behaviors translated into off-duty behaviors, particularly among the unvaccinated, where most did not wear a mask or socially distance while in public settings despite an executive order issued by the governor of North Carolina mandating such preventive measures.

Because EMS professionals are crucial components of the healthcare system, maintaining wellness among this group is paramount, and it is incumbent upon EMS administrators to ensure a protected EMS workforce. Nonetheless, overcoming vaccine hesitancy is particularly problematic in the context of COVID-19 because of the unprecedented politicization of vaccine development and public health responses to the pandemic, as well as the unbridled spread of misinformation, especially via social media.

Several health beliefs expressed by our respondents are core constructs of various health behavior theories, which include the health belief model,[13] the theory of reasoned action,[21] and the multi-attribute utility model.[22] Importantly, these beliefs represent targets for interventions for addressing vaccine hesitancy. Roughly half (50.5%) of respondents who listed a primary reason for remaining unvaccinated referred to vaccine misinformation including concerns about safety, effectiveness, side effects, acquiring COVID-19 illness from the vaccine itself, and general antivaccine sentiment (Table 3). These largely misinformation-based responses to vaccination may prove to be among the most difficult to overcome because broadly focused, information-based messaging alone is likely to be ineffective, particularly in light of the "backfire effect." The backfire effect is the tendency of individuals to resist accepting evidence that conflicts with their beliefs and subsequently become even more entrenched in their acceptance of misinformation, which can exacerbate nescience in such situations.[23] In addition, public health officials trying to educate the populace on mask wearing or other safety initiatives often issued confusing or contradictory information, leading to a lack of trust in the government to handle the pandemic properly.[24] These ideas are supported in that only 6.4% of the unvaccinated attributed a lack of sufficient information as their primary reason for declining the vaccine.

Instead of broadly focused messaging, some observers recommend that the underlying emotions, beliefs, and attitudes be identified and that messaging strategies be tailored to these attitudes.[25] Such strategies have included reporting the positive experience of vaccinated people to enhance overall trust in the vaccine[26, 27]; messaging that is people-centered and uses first-person accounts with emotional verbiage[28]; and the use of "trusted messengers" to disseminate information.[26]

Some have argued that the unvaccinated represent economic externalities and can therefore be addressed economically with both positive and negative financial incentives.[29] Examples of positive incentives that have been used include gift cards, food, alcoholic beverages, lotteries, and scholarships, while negative incentives may include increased health insurance premiums for the unvaccinated and denied access to schools or retail spaces. However, these strategies have not been thoroughly evaluated and their effectiveness is unknown. It is likely that a subset of the unvaccinated will not be swayed by either incentives or messaging campaigns, a group that French et al dub the "active resistors," who decline the vaccine based on strong personal, cultural, or religious beliefs.[30] Unfortunately, few tools exist for increasing vaccine uptake in this group, although one possible strategy is a mandatory workplace vaccination policy.

Policies mandating influenza vaccination of HCWs have gained popularity in some settings due to low vaccine uptake. Such policies consistently yield influenza vaccine uptake rates above 90% while simultaneously providing for medical and religious exemptions.[31] Similar policies for COVID-19 have been implemented for HCWs in some countries, including Greece and France.[32] In the United States, compulsory COVID-19 vaccination of HCWs is supported by 68 professional organizations, including the American Medical Association, American Academy of Pediatrics, American College of Physicians, American College of Surgeons, American Public Health Association, and National League for Nursing,[33] and has been implemented by many healthcare systems.[34] Moreover, the National Association of EMS Physicians joined these organizations in calling for mandatory COVID-19 vaccination for EMS professionals.[35]

Resistance to mandatory vaccination was intense among our surveyed EMS professionals where only 18.7% of our total respondents supported a mandatory vaccination policy. Again, even within this overall low level of support for mandatory vaccination, the degree of divergence of opinions between vaccinated and unvaccinated was stark. Mandatory vaccination was supported by 25.1% of the vaccinated respondents compared to 0.0% of the unvaccinated group. A total of 294 (34.2%) respondents overall supported an

alternative policy to make COVID-19 vaccination mandatory for EMS professionals, with a declination option similar to most policies addressing the hepatitis B vaccine. Overall, nearly half (47.1%) believed that COVID-19 vaccination should be entirely optional. Comparatively, in a similar survey of North Carolina paramedics regarding compulsory influenza vaccination, 52.3% believed vaccination should be entirely optional, 38.7% supported mandatory vaccination with the option to decline, and 9.1% agreed with compulsory vaccination.[16] Thus, it appears that opposition to mandatory COVID-19 vaccination is similar to that of influenza vaccination and has remained consistent over time among North Carolina EMS professionals. Consequently, although the feasibility and true impact of implementing such a strategy in EMS systems is unknown, resistance to a mandatory COVID-19 immunization policy in any form should be anticipated.

LIMITATIONS

This study has several notable limitations, and our results should be interpreted accordingly. First, our survey was web-based, voluntary, and subject to the usual response and recall biases, and the cross-sectional nature of the data prevented us from drawing any causal inference between attitude and belief variables and COVID-19 vaccine acceptance. Additionally, the survey invitation was emailed by the North Carolina Office of EMS via their data management vendor to ensure the provision of anonymity. The exact number of personnel who received the link is unknown. Thus, it isn't possible to calculate a survey response rate.

Our sample was comprised entirely of North Carolina EMS personnel and the generalizability of our findings to EMS professionals outside of North Carolina is unknown. Furthermore, the data was collected prior to the delta or omicron variants becoming the predominant circulating strain. The EMS vaccination rates may have since been influenced by the extensive attention given by public health officials to this strain of COVID-19 and its accompanying surge in cases, hospitalizations, and deaths.

Our survey did not specifically question respondents regarding understanding of or acceptance of one vaccine type vs another (mRNA vs viral vector). Nor did our survey specifically look at acceptance as it related to convenience, one dose vs two, or storage and distribution factors for the mRNA vaccines. Any targeted messaging campaign created to increase vaccine uptake should consider these variables and provide additional information as appropriate. Lastly, this survey was sent to EMS professionals who were active on an EMS agency roster. We did not survey those who were in other medical fields, educators, or those who may have been between jobs.

CONCLUSION

In this cross-sectional survey of North Carolina EMS professionals, COVID-19 vaccination rates were higher than have been previously reported, but a substantial subset remain at risk. Previous influenza vaccination, a perception of an increased risk for contracting the illness, sense of duty to protect patients, adequate information for decision-making, prior COVID-19 diagnosis, and favorable beliefs about vaccine safety and effectiveness were all predictive of vaccination acceptance. Nonetheless, erroneous beliefs and vaccine safety and effectiveness concerns were extensive, and resistance to mandatory vaccination was fervent. Notably, concern about safety was the most frequently cited reason for not accepting the COVID-19 vaccine. The EMS systems should focus their efforts on combating misinformation through strategically targeted employee educational campaigns as well as developing policies regarding immunization requirements and comprehensive workplace safety practices.

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A Qualitative Study of "What Matters" to Older Adults in the Emergency Department

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Introduction: The "4Ms" model – What Matters, Medication, Mentation, and Mobility – is increasingly gaining attention in age-friendly health systems, yet a feasible approach to identifying what matters to older adults in the emergency department (ED) is lacking. Adapting the "What Matters" questions to the ED setting, we sought to describe the concerns and desired outcomes of both older adult patients seeking ED care and their treating clinicians.

Methods: We conducted 46 dyadic semi-structured interviews of cognitively intact older adults and their treating clinicians. We used the "What Matters" conversation guide to explore patients' 1) concerns and 2) desired outcomes. We then asked analogous questions to each patient's treating clinician regarding the patient's priorities. Interviews were professionally transcribed and coded using an inductive approach of thematic analysis to identify emergent themes.

Results: Interviews with older adults lasted a mean of three minutes, with a range of 1–8 minutes. Regarding patients' concerns, five themes emerged from older adults: 1) concern through a family member or outpatient clinician recommendation; 2) no concern, with a high degree of trust in the healthcare system; 3) concerns regarding symptom cause identification; 4) concerns regarding symptom resolution; and 5) concerns regarding preservation of their current status. Regarding desired outcomes, five priority themes emerged among older adults: 1) obtaining a diagnosis; 2) returning to their home environment; 3) reducing or resolving symptoms; 4) maintaining self-care and independence; and 5) gaining reassurance. Responding to what they believed mattered most to older adult patients, ED clinicians believed that older adults were concerned primarily about symptom cause identification and resolution and primarily desired a return to the home environment and symptom reduction.

Conclusion: This work identifies concerns and desired outcomes of both older adult patients seeking ED care and their treating clinicians as well as the feasibility of incorporating the "What Matters" questions within ED clinical practice. [West J Emerg Med. 2022;23(4)579–588.]

INTRODUCTION

Older adults (those aged 65 years and over) account for over 23 million emergency department (ED) visits annually, representing 18% of all ED visits nationally.[1] Older adults have been noted to face unique challenges related to emergency care, including the potential receipt of goal-discordant care and a decreased attention to patient-centered care.[2,3] As a potential solution to address the underlying problems facing older adults more broadly in healthcare settings, the John A. Hartford Foundation and the Institute for Healthcare Improvement (IHI) founded the Age-Friendly Health Systems initiative in 2017.[4-7] As of June 2021,[4] there were over 2200 age-friendly health system participants employing the framework called the "4Ms" – What Matters, Medication, Mentation, and Mobility – to ensure patient-centered and evidence-based care for older adults across healthcare settings, with wider implementation in ambulatory and inpatient settings and less attention to the ED setting.[8-10]

Within EDs, efforts are increasing to prioritize patient-centeredness and goal-concordant care for older adults.[11,12] These areas of focus are particularly relevant and important for older adults as they have been identified in the outpatient setting to have health-related priorities aside from typical metrics such as repeat ED visits or hospitalization.[13-15] Furthermore, much of the available emergency care research regarding older adults' patient-centered goals currently focuses on treating clinicians performing end-of-life goals of care conversations.[16-18] However, ED treating clinicians are tasked with navigating older adult priorities not just during critical illness or end of life.

To date, the extant literature has not assessed whether ED treating clinicians perceive priorities that differ from their older adult patients, thereby potentially introducing goal-discordant care. Identifying what matters and priorities within the broader older adult population has drawn concerns regarding implementation strategies in the ED clinical environment as the lines of questioning often are perceived as time-intensive[19] or beyond the scope of a traditional ED visit focused on a single injury or symptom. Thus far, a feasible approach aligned with the Age-Friendly Health Systems to identify what matters to older adults seeking emergency care is lacking. Therefore, we sought to describe the priorities identified by older adults' and their treating clinicians as well as the feasibility of incorporating brief questions addressing what matters in the ED. Identifying the concerns and desired outcomes of older adults in a time-efficient approach that is aligned with the "What Matters" domain of the 4Ms framework will allow more patient-centered ED care for this growing population.

Population Health Research Capsule

What do we already know about this issue?
Older adults face unique challenges related to emergency care, including decreased attention to patient-centered and goal-concordant care.

What was the research question?
Can emergency clinicians identify concerns and desired outcomes of older adults using the "What Matters" conversation guide?

What was the major finding of the study?
"What Matters" questions in the ED are feasible, with clinicians and older adults exhibiting varied alignment.

How does this improve population health?
Identifying what matters to older adults should spur emergency physicians to pursue an evaluation, treatment plan, and disposition aligned with patients' goals.

METHODS

Study Design

We performed a qualitative analysis involving cognitively intact patients and their treating clinicians. Study methods and results are presented in accordance with the consolidated criteria for reporting qualitative research (COREQ).[20] This study was determined to be exempt research by the institutional review board.

Sample

The study was conducted at two EDs – a community hospital and a Level II trauma center – within the same health system. Potential older adult participants were identified based on screening within the electronic health record, with recruitment taking place during rotating evening and day schedules. Inclusion criteria included the following: age ≥70; English-speaking; ability to answer questions without the assistance of caregivers; and an Emergency Severity Index score of 3, 4, or 5 suggesting lower acuity at triage. Exclusion criteria included a status of medically unfit (as determined by the treating clinician) or evidence of cognitive impairment. We used the six-item screener, with a score of <4 on the six-point questionnaire indicating high risk for cognitive impairment, as previously performed in ED-based research.[21] Treating clinicians, including attending physicians and non-physician practitioners (eg, physician assistant, nurse practitioner), received a $5 gift card for their time participating in the interview. Enrollment occurred between December 2020–May 2021.

Procedures

A trained interviewer (HD) obtained verbal consent and digitally recorded interviews of older adults and their

treating clinicians. We conducted semi-structured interviews with a sample of older adult ED patients using an interview framework, the "What Matters in the ED" conversation guide (Supplement 1). The guide was modified from another Patient Priorities Care guide and developed by stakeholders and experts in work related to age-friendly health systems and emergency care.[22] Contextually, the "What Matters" conversation guide was developed to align the IHI Age-Friendly Health System initiative with the Geriatric ED Accreditation process endorsed by the American College of Emergency Physicians. The purpose of the "What Matters" conversation guide was to provide an outline for emergency clinicians to ask and learn about what matters to older adults presenting to the ED, with the knowledge gained contributing to care and treatment decisions.

An initial version of the "What Matters" conversation guide was tested in three EDs to gain clinician insights regarding appropriateness and feasibility (Supplement 1). We used the final two questions previously identified by expert consensus deemed to be most salient to identify what matters for older adults seeking emergency care.[23] To assess concurrent clinician impressions of their older adult patients, we asked analogous questions in a separate interview to the patient's ED treating clinician regarding what they believed mattered most to the older adult they were treating (Table 1). As suggested by stakeholder and expert guidance on the "What Matters" conversation guide, HD could ask either question 1a or 1b to ascertain fears or concerns about the older adult's healthcare in the ED, with a similar approach suggested for question 2a or 2b to identify outcomes most wanted. When identifying fears or concerns, HD's approach was to start the interview by asking question 1a. HD asked question 1b if the participant had difficulty understanding the question, needed further clarification, or it was thought that greater information could be gathered by rephrasing the question. The final interview guide was pilot tested with two ED patients prior to beginning the study.

Table 1. "What Matters" semi-structured interview guide for older adult patients and their treating clinicians.

Questions for older adult patients
1. One question to ascertain fears or concerns about healthcare in ED
a. What concerns you most when you think about your health and about being in the ED today/tonight? or
b. What fears and worries do you have about your health as you think about what brought you to the ED today/tonight?
2. One question about outcome patients most want from their ED visit
a. What outcome are you most hoping for from this ED visit? or
b. What are you most hoping for or looking for from your ED visit?
Questions for treating clinicians
1. What do you think the patient/family is concerned about today?
2. What outcomes do you think the patient is most hoping for?

ED, emergency department.

Both patients and clinicians were interviewed during the ED encounter when disposition uncertainty still existed. This occurred after the initial evaluation by the treating clinician, but before laboratory and imaging results were available to inform decision-making. HD timed interviews from the start of asking question 1 to the end of the participant's response to question 2 to assess the time and operational feasibility of incorporating "What Matters" questions into a typical ED encounter. HD collected basic demographic information and ED clinical data regarding the encounter and also recorded brief field notes immediately after the interview. No study authors were part of the participants' medical care teams.

Data Analysis

We used an iterative process of thematic analysis to synthesize the data, identify patterns, and develop themes across interviews.[24] Specifically, we used the inductive qualitative approach that relies on the synthesis of qualitative data, rather than relying on concepts considered a priori.[25] The coding team consisted of CJG, an emergency physician and health services researcher with formal qualitative training and expertise working with older adults, and HD, a masters-level research associate whom CJG trained on qualitative research techniques. Digitally recorded transcripts were professionally transcribed and corrected when the transcript passage was incomprehensible or had errors. We used NVivo 12 qualitative software (QSR International, Melbourne, Australia) to manage and analyze study data.[26]

The coding team began with a line-by-line review of transcripts and open coding to identify key concepts. Following review of the first six transcripts, coders developed an initial codebook that was subsequently expanded and refined through independent and then joint review of additional transcripts. Coding discrepancies were adjudicated between coders through regular meetings, and the final codebook, containing 22 codes across four domains, was then applied to all transcripts. Both coders coded all interviews to enhance consistency. Recruitment, interviewing, and coding occurred concurrently until thematic saturation was reached.[27] We followed best practices for validity in qualitative research by maintaining an audit trail and comments and revisions from group coding meetings.[28-30] The study team collaboratively identified and agreed upon illustrative quotes the represented the identified final themes. To preserve anonymity, participant quotes are identified by participant type and number.

RESULTS

We screened 58 older adults for eligibility; eight refused to participate and four were noted to be cognitively impaired,

leaving 46 older adults and their treating clinicians who agreed to participate and completed interviews. Older adult participants were primarily female, White, married, and had a mean age of 87 years. Characteristics of participants are shown in Table 2. The most common ED chief complaint category was "fall, musculoskeletal," and a significant portion of older adults underwent both laboratory testing (93%) and radiograph imaging (70%). Interviews with older adults lasted a mean of three minutes, with a range of 1–8 minutes. Treating clinicians consisted of physicians and non-physician practitioners (Table 2).

When considering responses to the first "What Matters" question regarding fears or concerns about the older adult's ED care, five main themes emerged among older adult respondents and two main themes emerged among clinician respondents. For older adults, these themes included the following: 1) concern through a family member or outpatient clinician recommendation; 2) no concern, with a high degree of trust in the healthcare system; 3) concerns regarding symptom cause identification; 4) concerns regarding symptom resolution; and 5) concerns regarding preservation of their current status. For clinicians responding to what they believed the older adult patient was most concerned about, the two themes included 1) concerns regarding symptom cause identification and 2) concerns regarding symptom resolution.

When considering responses to the second "What Matters" question regarding desired outcomes about the older adult's ED care, five main themes emerged among older adult respondents and three main themes emerged among clinician respondents. For older adults, these themes included the following: 1) obtaining a diagnosis; 2) returning to their home environment; 3) reducing or resolving symptoms; 4) maintaining self-care and independence; and 5) gaining reassurance. For clinicians responding to what outcomes they believed the older adult patient most desired, the three identified priority themes included 1) returning to their home environment, 2) linking reassurance and return to home environment outcomes, and 3) reducing or resolving symptoms. Tables 3 and 4 show representative quotes of the identified themes.

Table 2. Sample characteristics.

Variable	N = 46
Age, mean (SD)	87 (7)
Female, n (%)	27 (57)
Race, n (%)	
White	37 (80)
Black	7 (16)
Other	2 (4)
Ethnicity, n (%)	
Hispanic or Latino	2 (4)
Non-Hispanic	44 (96)
Marital Status, n (%)	
Single	4 (9)
Married	22 (48)
Divorced	3 (6)
Widowed	15 (33)
Other	2 (4)
Chief Complaint Category, n (%)	
Fall, musculoskeletal	16 (35)
Weakness, fatigue, dizziness	11 (24)
Cardiopulmonary	10 (22)
Other	9 (19)
ED Evaluation, n (%)	
Labs	43 (93)
Radiograph	32 (70)
Ultrasound	4 (9)
CT imaging	16 (35)
Final ED Disposition, n (%)	
Admit	26 (57)
Discharge	20 (43)
ED Diagnosis Category, n (%)	
Musculoskeletal	12 (26)
Infection	7 (15)
Cardiopulmonary	8 (18)
Metabolic, electrolyte disturbance	7 (15)
Other	12 (26)
Interview time of day, n (%)	
9 AM-4 PM	16 (35)
4 PM-11 PM	30 (65)
Clinician type, n (%)	
Physician	34 (74)
Non-physician practitioner	12 (26)
Average patient interview length, min (range)	3 (1-8)

SD, standard deviation; *ED,* emergency department, *CT,* computed tomography.

Insights into Older Adults Concerns

Older adults reported a wide variation of concerns when thinking about their health and healthcare during the ED visit. Older adults either presented to the ED at the suggestion of a family member or the recommendation of an outpatient clinician, while an additional group were not concerned at all with their ED care and noted their "total confidence" in the ED treating clinicians. When present, concerns and fears of older adults included symptom cause identification and symptom resolution (eg, knee pain), but more frequently also extended to include the ramifications that the acute injury or illness would have on their broader life. These areas of concern for older adults centered commonly on ambulatory

Table 3. Fears and concerns related to emergency care of older adults and their treating clinicians.

Question #1 – Fears and concerns about healthcare in the ED?	
Theme	Exemplar quotes
Older adults	
Theme 1: Concern through a family member or outpatient clinician recommendation	One of my doctors did not like the result of a blood test that I had taken last Friday and he did not like the result of my blood pressure today. (Participant)
	I really did not want to come, but my kids made me come. (Participant)
	Well, I haven't paid a great deal of attention to my health. My wife has been at me to be more concerned about how I feel, what's happening, and what I need to feel better. (Participant)
Theme 2: No concern, with a high degree of trust in the healthcare system	When I came into the emergency department tonight, I was treated with respect, and I love being here because at least I get some progress. (Participant)
	I don't know if I have any concerns, because I have total confidence that they are going to take care of the problem. (Participant)
	Nothing really, because I'm in good hands. They know what they're doing. I have no worries about it. (Participant)
Theme 3: Concerns regarding symptom cause identification	I would say what concerns me the most is finding out what is my problem. (Participant)
	What concerns me most is that I just want to find out what's going on with my health and my body. (Participant)
	Finding out what is really wrong with me. (Participant)
	Finding out what is wrong with me. (Participant)
Theme 4: Concerns regarding symptom resolution	I have pain in my left hip, which is totally unexplainable. (Participant)
	Being able to feel better and poop, because I have been eating, but nothing's been coming out and it's very uncomfortable. (Participant)
	Getting rid of the pain that I got. (Participant)
	To get better…I felt like I was going to faint and my legs gave way. (Participant)
	I feel awful, I feel so nauseous. So that is concerning to me be because I really do not want to mess myself or anything you know. (Participant)
Theme 5: Concerns regarding preservation of their current status	Mobility – I have a heart condition, an artificial knee – mobility is the big issue. (Participant)
	I am just concerned that I will not get back to normal. (Participant)
	I fell, and if my knee gets hurt I don't know if I will ever walk again. (Participant)
	I want to be by myself, and I want to take care of myself. I don't move much at home because I have a hard time getting up and moving. (Participant)
Clinicians	
Theme 1: Concerns regarding symptom cause identification	I think he is most concerned about the source of his pain. (Clinician)
	He is definitely concerned about his left knee pain. He thinks he has another infection, because he has a history of similar. (Clinician)
	I think one of the main things that he is concerned about is the dizziness that he does not know where it is coming from. (Clinician)
Theme 2: Concerns regarding symptom resolution	I think he is concerned that he has an infection that has not been improving on antibiotics. (Clinician)
	Persistent shortness of breath that has not been treated. (Clinician)
	The pain in her back. (Clinician)
	He was concerned that he was not urinating. (Clinician)
	The patient's main concern was the discomfort in her right shoulder and left knee after falling today. (Clinician)

Table 4. Desired outcomes related to emergency care of older adults and their treating clinicians.

Question #2 – Outcome most hoping for from this ED visit?	
Theme	Exemplar quotes
Older adults	
Theme 1: Obtaining a diagnosis	The doctors will find whatever is causing the pain and we will just move on. (Participant)
	To actually just learn what is wrong. (Participant)
	Find out what is causing this. (Participant)
Theme 2: Returning to their home environment	That I do not have to have any operations and I can go home soon. (Participant)
	To go home. (Participant)
	Nothing really, because I'm in good hands. They know what they're doing. I have no worries about it. (Participant)
	That I can be bandaged up and go home. (Participant)
	Recovery back home. (Participant)
	To be able to go back to the facility where I reside. (Participant)
Theme 3: Reducing or resolving symptoms	No recurring symptoms. (Participan)
	Get rid of the pain. I can tolerate discomfort, but pain management today. (Participant)
	I am hoping that my stomach will go down and I will [be] able to poop and feel better. (Participant)
	To get rid of the pain. (Participant)
Theme 4: Maintaining self-care and independence	I want to get back to where I can be myself because I used to love to exercise. I used to love to walk and it seems like I can't even do none of that now, and I am an independent person and I like doing for myself and I hate when I have to have other people to do for me. (Participant)
	That I know what to do to better take care of myself. (Participant)
Theme 5: Gaining reassurance	Something that doesn't incur surgery. (Participant)
	Everything is normal. (Participant)
	I hope there is nothing wrong. (Participant)
Clinicians	She wants to go home. (Clinician)
Theme 1: Returning to their home environment	Could be able to be discharged home. I think it is what she is hoping for. (Clinician)
	Ability to go back to Assisted Living. (Clinician)
	I think he hoped that he could go home. (Clinician)
Theme 2: Linking reassurance and return to home environment outcomes	He is hoping that I tell him that that is not the case [an infected knee] and he gets to go home. (Clinician)
	I think that she is hoping that everything is negative and she gets to go home. (Clinician)
	To be discharged from the emergency department today, and to have reassurance that he does not have a fracture or new blood clot. (Clinician)
	I think she was hoping that she would be cleared with basic emergency department evaluation and be able to go home. (Clinician)
	I think ultimately she would like to be discharged home and be told everything is looking good. (Clinician)
Theme 3: Reducing or resolving symptoms	The bleeding to stop. (Clinician)
	Probably pain control and her arm healing. (Clinician)
	To feel better and not be short of breath. (Clinician)

ED, emergency department.

status and preservation of their current abilities (Table 3). One participant stated, *"I am just concerned that I will not get back to normal." (Participant)*

When asked to consider the older adults' concerns, treating clinicians referenced symptom cause identification and symptom resolution as the patient's greatest concern or fear, with no comment on the perceived impact that the older adult identified on daily life or function. Highlighting potential discordance regarding concerns, one older adult and their treating clinician separately noted:

"I have a heart condition. I have an artificial knee, and it looks like I might be getting another artificial knee. Mobility is the big issue." (Participant)

"I think he is concerned about his left knee pain that is recurrent." (Clinician)

Insights into Older Adults Desired Outcomes

Older adults and clinicians also reported a wide array of desired outcomes for the older adult during the ED visit. Individuals from both groups identified that the desired outcomes of older adults during ED care included returning to their home environment and reducing or resolving symptoms. Highlighting concordance between patients and treating ED clinicians, one older adult and their treating clinician separately noted:

Interviewer: "What outcomes are you most hoping for from this ED visit?"
Participant: "To be able to go back to the facility where I reside." (Participant)
"I think ultimately she would like to be discharged and be told everything is looking good." (Clinician)

Expressing desired outcomes from their ED visit, an older adult and their treating clinician also noted:

"That my head is clear, and I can go home and get on with my life." (Participant)
"I think they would like to go home, but they are also concerned about his head." (Clinician)

However, older adults additionally noted obtaining a diagnosis, maintaining self-care and independence, and gaining reassurance as desired outcomes from their ED visit. Treating clinicians linked desired outcomes of older adults, most commonly identifying their desire to gain reassurance alongside their desire to return to their home environment. However, clinicians did not perceive that maintaining self-care and independence were desired outcomes of older adults seeking emergency care (Table 4). Highlighting potential discordance regarding desired outcomes, one older adult and their treating clinician separately noted:

"I want to get back to where I can be myself because I used to love to exercise. I used to love to walk, and it seems like I can't do any of that now. I'm an independent person, and I like doing for myself, and I hate when I have to have other people do for me." (Participant)

"I think they want an answer as to the cause of the shortness of breath primarily, and then also to treat it." (Clinician)

DISCUSSION

This study is the first to characterize perspectives of older adults presenting to the ED using the "What Matters" framework. The unique comparison to their treating clinicians offers evidence demonstrating alignment in some areas despite other distinct gaps between older adults and their ED treating clinicians. Importantly, this work identifies the feasibility of incorporating the "What Matters" questions in the ED.

Unique to our work is the identification of what older adults are concerned about and prioritize while seeking emergency care, *and* whether clinicians are aware of what matters to this population. In our study, clinicians often recognized the importance of returning to the home environment for older adults, but they did not comment on patients' frequently expressed concerns regarding the impact of the acute illness or injury on their ability to return to their previous functional or broader health status. The emergency clinicians rarely mentioned functional changes as a concern of the older adult despite prior ED- and hospital-based literature identifying subsequent objective functional decline and adverse outcomes.[31-36] Our qualitative study adds to the literature base by providing more in-depth responses than possible via survey-based quantitative research.

The extant literature lacks relevant feasible modalities to address the priorities of older adults seeking emergency care. Many, including the "What Matters" structured tool and the "Serious Illness Conversation Guide,[37] have been developed and assessed in non-ED settings, thereby limiting their translatability to patients seeking acute care. In our study, the average patient interview was three minutes and ranged from 1–8 minutes, suggesting a reasonable time to completion and feasibility of clinicians incorporating the "What Matters" questions within the time constraints of today's ED clinical practice. We believe emergency clinicians are best situated to ask the "What Matters" questions, as their upfront efforts to address patient priorities, concerns, and desired outcomes may ultimately save time and resources in place of potentially contentious and goal-discordant conversations after completion of the ED evaluation.

Additionally, Hunold et al asked a single, open-ended question to older adults regarding what would make their ED visit successful, useful, or valuable.[38] Without restricting when during the visit the interview occurred, 62% of participants reported at least one priority in the "evaluation, treatment, and outcomes" meta-category, including treatment of the medical problem, accurate diagnosis, and competent clinical

staff. Our study builds upon this work by providing more in-depth qualitative responses as well as standardizing the interview time during the clinical encounter – after initial clinician evaluation but before laboratory and imaging results. This timing ensured uncertainty regarding the disposition and allowed patients to reliably and consistently relay priorities at a critical juncture in the ED visit. It remains to be determined whether these questions may be most effective in guiding ED care if asked at the initiation of the visit, prior to evaluation.

Our work has several implications regarding clinical practice. Cognitively intact older adults identified several concerns regarding their health in comparison to their treating clinicians, suggesting that emergency clinicians may be unaware of certain patient priorities during the encounter. A standardized script, such as the "What Matters" conversation guide, may prompt clinicians to incorporate patient-centeredness and shared-decision making into the patient encounters. Identifying what matters in the ED when caring for older adults is intended to promote clinicians to pursue an evaluation, treatment plan, and disposition aligned with the goals of the patient, potentially saving both time and financial resources if an extensive in-ED evaluation is not prioritized or desired by the patient. The Age-Friendly Health System initiative may serve as a platform for the broader implementation in the ED of the "What Matters" conversation guide to target increased patient-centered emergency care of older adults, creating alignment with the recent development of geriatric ED guidelines and the Geriatric ED Accreditation (GEDA) process.[39,40] Future research should build upon this foundation and quantitatively identify domains targeting what matters that can be incorporated within novel patient-reported outcome measures and may benefit from determining differences between GEDA and non-GEDA EDs in addressing the "What Matters" questions.

LIMITATIONS

There are limitations of our study to consider. Our study was conducted at EDs within one health system and predominantly among White older adults, thereby potentially restricting generalizability. However, we expect that many older adults will have similar experiences as we identified thematic saturation during our qualitative analyses. Our understanding and interpretation of the data may have potentially introduced confirmation bias, which we attempted to minimize using semi-structured interview guides and discrepancy reconciliation through team discussion. Additionally, the two primary interview reviewers were not blinded to the study objectives, thereby potentially introducing bias to the decision of classification of the questionnaire domains. While we did follow multiple best practices for rigor in qualitative research,[28-30] we did not return transcripts to participants for checking of our themes. Finally, "feasibility" has been defined in several ways within the literature. Aside from the time taken to conduct the interviews, additional quantitative survey feedback from older adults and ED treating clinicians may be beneficial to support further operational implementation.

CONCLUSION

Patients and their treating clinicians noted similar concerns and desired outcomes when considering the priorities of older adults. However, clinicians did not as frequently recognize patients' concerns about the impact of their acute condition on overall function and daily life. We have identified the feasibility of incorporating these two "What Matters" questions in the ED and the limited time needed to identify older adults' priorities

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Intimate Partner Violence, Sexual Assault, and Child Abuse Resource Utilization During COVID-19

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Introduction: Key measures in preventing spread of the virus that causes coronavirus disease 2019 (COVID-19) are social distancing and stay-at-home mandates. These measures along with other stressors have the potential to increase incidences of intimate partner violence (IPV), sexual assault, and child maltreatment.

Methods: We performed a retrospective review of county police dispatches, emergency department (ED) visits, Sexual Assault Nurse Examiner (SANE) consults, Domestic Violence Healthcare Project (DVHP) team consults, and Child Protection Team consults at a large, tertiary, Level I trauma center. We queried International Classification of Diseases Revision 10 codes most specific to IPV, sexual assault, and child maltreatment from March–October 2020 compared to 2019. Similarly, the number of consults performed by SANE, DVHP, and our Child Protection Team were collected. We compared all ED visits and consultations to total ED visits for the reviewed time period. Finally, the total number of calls and referrals to a child advocacy center and resource call line for victims were recorded during this timeframe.

Results: Police dispatches for IPV-related assaults increased by 266 reports from 2019 to 2020 (P = 0.015). Emergency department visits related to IPV increased from 0.11% of visits in 2019 to 0.15% in 2020 (P = 0.032), and DVHP consults increased from 0.31% in 2019 to 0.48% in 2020 of ED visits in the first three months (P < 0.001). Child maltreatment visits increased from 0.47% of visits in 2019 to 0.81% of visits in 2020 (P = 0.028), and a higher percentage of patients required Child Protection team consults from 1% in 2019 to 1.6% in 2020 (P = 0.004). Sexual assault-related visits and SANE consults both showed a small increase that was not statistically significant. Fewer calls and referrals were made to our child advocacy center and resource call line, decreasing by 99 referrals and 252 calls, respectively.

Conclusion: Despite decreased ED volumes throughout the pandemic, we observed an increase in police dispatches, ED visits, and utilization of hospital consult services related to IPV and child maltreatment following the initiation of stay-at-home orders. However, use of community resources, such as the local child advocacy center, declined. [West J Emerg Med. 2022;23(4)589–596.]

INTRODUCTION

As of December 2021, the coronavirus disease 2019 (COVID-19) pandemic has affected more than 270 million people and caused more than five million deaths worldwide.[1] North Carolina has reported greater than 1.5 million cases and 19,000 deaths.[2] One of the primary mitigation measures to prevent the spread of COVID-19 has been social distancing enforced by a variety of state, county, and city restrictions.[3,4] Mecklenburg County, the largest county by population in North Carolina, issued its stay-at-home order on March 24, 2020, followed shortly with a statewide mandate by the governor on March 27, 2020.[5-7] Under these mandates, people were advised to leave their home only for essential purposes, gatherings were limited to 10 people, childcare centers were open for essential workers only, and most other retail and social services were closed. This was followed by an initial three-phase system of de-escalation of these social restrictions dependent upon the state of the pandemic that began to once again escalate in November 2020.

Social distancing has been an essential component in limiting the spread of the severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) virus.[4] However, given the unprecedented nature of this pandemic, little evidence exists to define the types of services and resources that should be expounded upon or limited in response to this protective measure. Social distancing has the potential to increase the incidence of unseen IPV, sexual assault, and child maltreatment. With stay-at-home orders in place, victims may have limited ability to escape their abusers while also being less visible to mandatory reporters or other sources of support. The transition to virtual school may decrease opportunities for children suffering from abuse or neglect to be recognized or to seek help. In addition, other social stressors contribute to increased risks of violence. Rising unemployment levels, mass hysteria, and documented surges of racism and xenophobia in combination with the mental effects of isolation have resulted in worsening psychologic and financial stressors.[8] Poverty and financial pressures have been repeatedly demonstrated to correlate with higher rates of child maltreatment and IPV.[9,10]

In our study we looked to further clarify the relationship between social distancing, the COVID-19 pandemic, and resource utilization by victims of IPV, sexual assault, and child maltreatment within our community. Notably, Mecklenburg County had the highest number of violent crimes and total crime index reported in North Carolina in 2019.[11] Historically, this area has also had a high percentage of child maltreatment cases, with 14,233 complaints filed in 2018, comprising nearly 5% of all children in the county.[12] Despite the local prevalence of violent crime and abuse, several community resources serving victims were closed or downscaled at the beginning of the pandemic, while others shifted their response to a virtual platform and maintained services. However, essential agencies such as police and emergency medical services (EMS) as well as local emergency departments (ED) continued to function throughout the pandemic regardless of the stay-at-home mandates. Considering the multifaceted nature of victim identification and reporting, our study looked to several resources in our community to examine the incidences of reported abuse and assault during the COVID-19 pandemic.

Population Health Research Capsule

What do we already know about this issue?
Disasters and social isolation can potentially increase the risks of intimate partner violence (IPV), sexual assault, and child abuse in vulnerable populations.

What was the research question?
We studied resource utilization by victims of IPV, sexual assault, and child abuse in Charlotte, NC, during the COVID-19 pandemic.

What was the major finding of this study?
We found similar or increased rates of police calls and hospital visits but decreased use of community resources.

How does this improve population health?
Further consideration is needed during natural disasters and social distancing to account for violence in the home and the ability of victims to access resources.

METHODS

Following study approval by the institutional review board, we performed a retrospective review of several prehospital, hospital, and outpatient advocacy centers that provide resources specific to IPV, sexual assault, and child maltreatment. Volumes of visits, calls, and consults in the Charlotte-Mecklenburg County region were compared from 2019 to 2020. We queried records starting from the initial month of declared states of emergencies and stay-at-home mandates through the following seven months and compared data to the same timeframe from the previous year, from March 1–October 31, 2020, and March 1–October 31, 2019. After this time, social distancing mandates again briefly escalated and underwent more rapid and less consistently enforced changes; thus, we looked to capture only the initial response during the pandemic.

We queried dispatch records from the Charlotte-Mecklenburg Police Department (CMPD) for assault during

this timeframe. The CMPD assault cases had been specifically filtered per standard CMPD protocols and categorized as related to IPV. The training and criteria for this categorization did not undergo changes during the timeframe of our study.

We reviewed Sexual Assault Nurse Examiner (SANE) consults, Domestic Violence Healthcare Project (DVHP) advocacy team consults, and Child Protection Team consults that took place at a Level 1 trauma center that sees approximately 80,000 adult and 30,000 pediatric patients annually. We saw a significant decrease in the total number of patients presenting to the ED during the pandemic. To account for the overall decreased ED volume during this time, we compared the total number of consults as well as the percentage of patients with an ED visit requiring these services in the delineated timeframe.

Additionally, we examined ED visits at this center related to abuse and sexual assault. Patient encounters were queried with *International Classification of Diseases 10th Revision* (ICD-10) codes specific to IPV, sexual assault, and child maltreatment (Supplemental Table 1). Again, visits were compared relative to total ED volumes and reported as percentages for the time period described above to account for fluctuating patient volumes. The ICD-10 codes and variables were defined as above with case selection criteria discussed and agreed upon among all authors. Authors acted as data abstractors and were trained prior to chart review and therefore were not blinded. Although this study focused on the overall number of patient encounters in the ED coded with ICD-10 codes specific to IPV, sexual assault and child maltreatment, we reviewed a random sample of charts for these encounters to ensure that the charts were properly coded based on clinician documentation. Two abstractors reviewed 15% of charts, and using Cohen's kappa they then analyzed the charts for inter-rater reliability of the categorization of the ICD-10 code documented in the patient encounter. Except where otherwise reported, data was analyzed using Wilcoxon rank-sum and chi-square analysis with a two-tailed hypothesis, and $P < 0.05$ was considered statistically significant. We held regular meetings to discuss chart review results, and any charts in which it was not clear whether an ICD-10 code under the designated categories was appropriate based on clinician documentation were reviewed by the group and consensus reached.[13]

Finally, the total number of consults and basic demographic information was obtained from two outpatient resources. Investigators were provided deidentified call logs from Safe Alliance's Greater Charlotte Hopeline. Safe Alliance is a Charlotte-based nonprofit organization that provides resources and counseling for victims of sexual assault and IPV. Additionally, metrics were obtained from Pat's Place Child Advocacy Center, a child-friendly facility that performs forensic interviews and provides family advocacy services, as well as helps to coordinate investigation, prosecution, and treatment of child maltreatment cases in Mecklenburg County. Pat's Place accepts referrals from both the Department of Social Services (DSS) as well as law enforcement.

RESULTS

In 2020, there were 5219 reports of IPV documented by the CMPD compared to 4953 reports in 2019 (Figure 1), significantly increasing by 266 reports ($P = 0.015$). As seen in Table 1, the majority of victims were 18-29 years old,

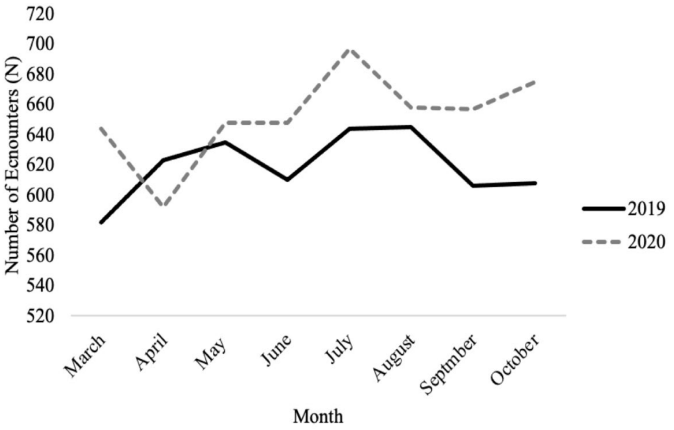

Figure 1. Charlotte-Mecklenburg Police Department encounters for intimate partner violence-related assaults from 2019-2020.

Table 1. Charlotte-Mecklenburg Police Department demographic data for all encounters categorized as intimate partner violence-related assaults from 2019-2020.

Demographics	Cases 2019 (N)	Cases 2020 (N)	P-value
Total	4,953	5,219	*0.015
Age			0.363
18-29	2,122	2,280	
30-39	1,338	1,428	
40-49	823	800	
>50	670	711	
Race			0.413
Amer In/ Alaska Nat	3	9	
Asian	41	46	
Black	3,393	3589	
Native Hawaiian	3	5	
White	1,449	1,477	
Unknown	64	95	
Gender			0.556
Male	1,350	1,396	
Female	3,601	3,823	

Note: * significant at P < 0.05.
Amer In/Alaska Nat, American Indian/Alaska Native.

Black, and female across both study time periods. The most common charge against the perpetrator was non-aggravated assault followed by aggravated assault, both of which increased in 2020 compared to 2019 ($P < 0.001$ and $P = 0.005$, respectively) (Supplemental Table 2). Increased or similar rates of all types of perpetrator charges were reported with the exception of rape, which modestly decreased in 2020 from 37 reports to 29 ($P = 0.213$). Comparable rates of death, gun threats, and serious injury were reported. Of note, more victims were treated on scene and released ($P = 0.015$). While 77 more people refused treatment in 2020 compared to 2019, these differences were not statistically significant ($P = 0.798$).

In review of hospital resources, there were significant increases in ED visits leading to hospital admissions requiring Child Protection Team consults from 1% to 1.6% ($P = 0.004$) (Figure 2). The majority of children were White and Black, ages 0-5 (Table 2). There were slightly fewer total numbers of consults, with 182 consults in 2020 compared to 189 consults in 2019. When accounting for the substantial decrease in pediatric ED volumes in 2020, this shows a significant increase in visits requiring Child Protection Team services on average and across every month of the eight-month study period.

Similarly, the full number of consults for DVHP and SANE services decreased over our time frame in 2020, but a higher percentage of patients required DVHP and SANE services when accounting for ED volumes (Figures 3 and 4). However, only the proportional increases in DVHP consults in the first three months were statistically significant, increasing from consulting on an average 0.31% of visits in 2019 to 0.48% of visits in 2020 ($P < 0.001$). Over the full study timeframe, DVHP consults increased from .38% of visits in 2019 to .45% of visits in 2020 ($P = 0.060$). In 2020 SANE was consulted in 0.40% of ED visits compared to 0.34% in 2019, but this was not a significant increase ($P = 0.226$).

When reviewing ICD-10 codes for ED visits, we identified the 41 most applicable codes (Supplemental Table 1). As seen in Figure 5, there were proportional increases in the percentage of ED visits for IPV and child maltreatment during the study timeframe ($P = 0.031$ and $P = 0.028$, respectively). There was also a small, but statistically insignificant, increase in ED visits with ICD-10 codes related to sexual assault ($P = 0.743$). Fifteen percent of the charts were selected, and the ICD-10 codes were reviewed and categorized by a second trained investigator into one

Table 2. Demographic data for patients with a Child Protection Team consult from 2019-2020.

Demographics	Cases 2019 (N)	Cases 2020 (N)	P-value
Total	189	182	0.833
% of ED Visits	1.0%	1.6%	*0.004
Age			0.820
0-5	149	148	
6-12	15	12	
13-17	25	22	
Race			0.904
Amer Ind	2	4	
Asian	5	5	
Black	68	75	
Latinx	17	18	
White	80	76	
Unknown	5	0	
Gender			0.794
Male	95	89	
Female	93	92	

Note: *significant at P < 0.05.
ED; emergency department; Amer Ind, American Indian.

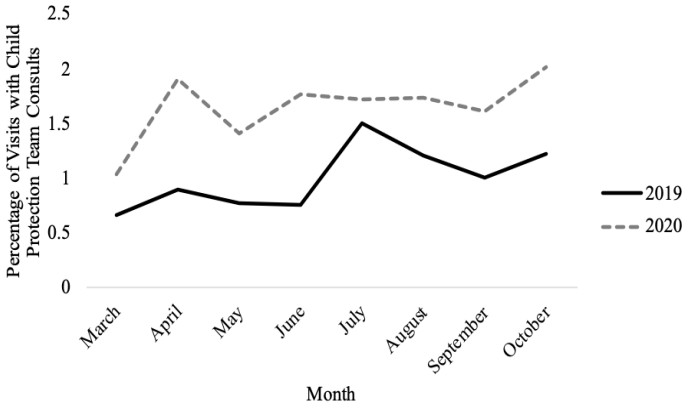

Figure 2. Percentage of emergency department visits with Child Protection Team consults from 2019-2020.

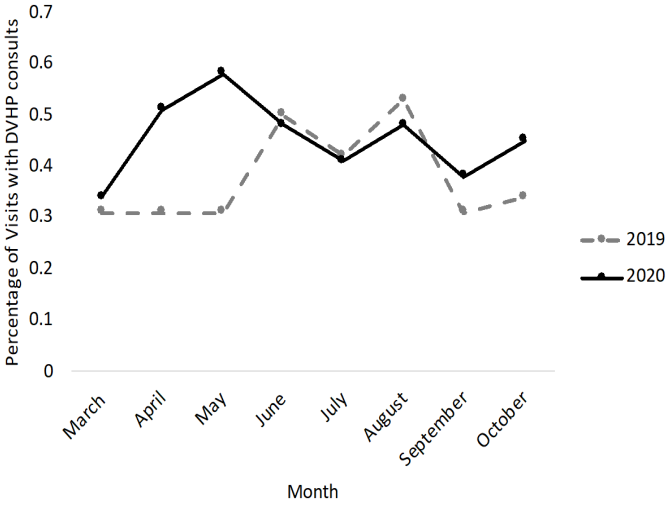

Figure 3. Percentage of emergency department visits with Domestic Violence Healthcare Project team consults from 2019-2020.

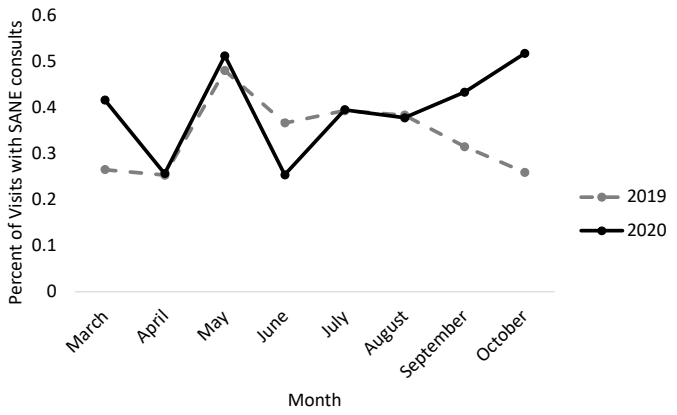

Figure 4. Percentage of emergency department visits with Sexual Assault Nurse Examiner consults from 2019-2020.

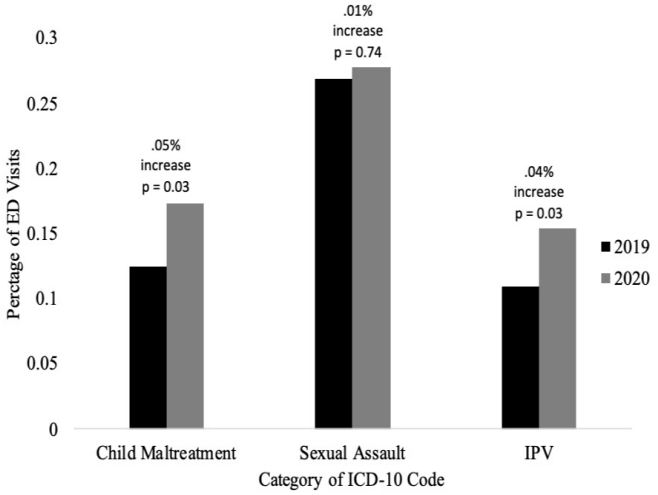

Figure 5. Percentage of emergency department visits with ICD-10* codes related to child maltreatment, sexual assault, and intimate partner violence.
**ICD-10, International Classification of Diseases 10th Revision.*

of the categories of IPV, sexual assault, child maltreatment, or removal from the study if it was not applicable with perfect agreement, to include 173 of 187 charts. There was disagreement on one chart in the categorization as IPV, sexual assault, or child maltreatment with almost perfect agreement at 99.5% and Cohen's k = 0.993.

Referrals to Pat's Place Child Advocacy Center decreased, with 410 referrals in 2019 and 311 referrals in 2020. A higher percentage of cases were referred from DSS compared to law enforcement, at 33% vs 27%, respectively. The Safe Alliance Greater Charlotte Hope Line fielded marginally fewer callers in 2020 compared to 2019, from 6518 to 6770. There was a decrease in primary and secondary call reasons for IPV from 5,059 in 2019 to 4,764 in 2020 ($P < 0.001$). Certain services provided through the hotline increased and included advocacy, caregiver education, court education, crisis intervention, emotional support, legal resource information, prevention, and safety planning compared to the previous year (Supplemental Table 3). Given the multitude of sources with varying trends, the data across each source was consolidated (see Table 3).

DISCUSSION

The COVID-19 pandemic has had a profound effect on our community and on another ongoing crisis in our nation: IPV and violence in the home. While we know that all persons are at risk of experiencing IPV, those most affected are females of color, as reflected in our CMPD and Safe Alliance data.[14] We found that Black females aged 18-29 made up the highest proportion of reports of IPV and sexual assault as well as the highest number of calls to the hotline for support.

Social determinants of health affect all facets of life including responses to disasters. The financial and social stresses of rising job instability and losses, childcare, and ability to afford and successfully participate in virtual schooling is poised to have profound effects on victims and abusers. Economic inequalities in a relationship and poverty have been shown to increase risks of IPV.[14] The pandemic has disproportionately affected women, minorities, immigrants, and workers without a college education, increasing the risks to some of the most vulnerable people in our community.[15,16] Previous literature demonstrated that natural disasters and stay-at-home guidelines increase reports of sexual assault, IPV, and support services needed for victims.[17,18] A review of assault cases in Florida over a nine-year period demonstrated increased assault rates by approximately 78 cases per year during prolonged exposures to natural disasters, defined as >199 days of declared disaster.[18] Similarly, a review of child maltreatment cases reported after natural disasters Hurricane Hugo, Hurricane Andrew, and the Loma Prieta earthquake found substantial increases for 3-6 months afterward.[19] However, information from these studies is often limited as there is variability in reporting methods, definitions of abuse, and methodologies as evidenced in a meta-review of child maltreatment reports related to natural disasters in the US, which showed conflicting relationships between natural disasters and child maltreatment.[20]

Our study found consistent increases in utilization of resources for child maltreatment during the COVID-19 pandemic. Both White and Black children were among the highest groups seen by our Child Protection Team, and we saw equitable total numbers of consults and significantly increased percentages of ED visits requiring their services across all months of the pandemic. When looking at ED visits, there were significant increases in the percentage of visits coded as related to child maltreatment. Despite this increase, we saw fewer referrals to Pat's Place and fewer calls to Safe Alliance for child maltreatment. Referrals to Safe Alliance were made by calling their Hope Line, and it is certainly

Table 3. Summary of trends rates of various types of reports of intimate partner violence, sexual assault, and child maltreatment from 2019 compared to 2020.

Summary table	2019	2020	P-value
IPV			
Police: IPV-related assault (# of dispatches)	4953	5219	*0.015
DVHP consults (% of ED visits)	0.38%	0.45%	0.114
ED: ICD-10 codes (% of ED visits)	0.11%	0.15%	*0.039
Safe Alliance: IPV (# of calls)	5059	4764	*<0.001
Sexual Assault			
Police: IPV-related rape (# of dispatches)	41	33	0.222
SANE consults (% of ED visits)	0.34%	0.40%	0.226
ED: ICD-10 codes (% of ED visits)	0.27%	0.28%	0.785
Safe Alliance: Sexual Assault (# of calls)	649	584	*0.010
Child Maltreatment			
CPT consults (% of ED visits)	1%	1.64%	*<0.001
ED: ICD-10 codes (% of ED visits)	0.12%	0.17%	*0.034
Safe Alliance: Child Maltreatment (# of calls)	148	118	0.056
Pat's Place (# of referrals)	410	311	*0.156

Note: *significant at P < 0.05.
IPV, intimate partner violence; *DVHP*, Domestic Violence Healthcare Project; *ICD-10,* International Classification of Diseases 10th Revision*; SANE*, Sexual Assault Nurse Examiners; *ED,* emergency department; *CPT,* Child Protection Team.

possible with the stay-at-home mandate that victims had less opportunity to even make a phone call. Changing work hours, closures, and limited staffing in the early portion of the stay-at-home mandate at Pat's Place and Safe Alliance could have also affected referrals. However, this suggests that across both cases, adults are not engaging with outpatient resources that require calling, and it may be that the lack of ability to get away from abusers affected the ability to access call and support lines. However, this is still a speculative relationship that requires further research.

Within our data, we found similar rates of sexual assault from the previous year, both in police dispatches, SANE consults, and ED visits. Similarly, although we had initial increases in DVHP consults within the first three months of the pandemic, there were not significant changes after this time. The first three months of our study represented the strictest degree of social distancing, with recommendations to leave the house only for essential purposes, thereby providing more contact with abusers, which may have had a greater impact on rates of IPV.

While our hospital consult services saw only early increases in utilization, we saw increasing reports to CMPD of assault related to IPV and ED visits coded as related IPV across the entire study timeframe. This confirms that we are seeing at least similar levels of sexual assault and increased incidence of IPV in our community as we would expect given the unique psychological and financial stressors related to social distancing and the pandemic. Additionally, we know that there has been an overall decrease in patients seeking medical attention during the pandemic, often out of fear of contracting the virus, which may have further decreased utilization of healthcare resources for IPV, sexual assault, and child maltreatment.[21-24] Therefore, it is of particular note that despite well-documented avoidance of healthcare during the early pandemic, we continued to see instances of similar and higher percentages of patient's presenting to the ED for IPV, child maltreatment, and sexual assault and requiring hospital-specific consult services for victims.

LIMITATIONS

Our study had several limitations. Specifically, we found variability in documentation and coding of ED visits for possible child maltreatment, IPV, and sexual assault. When evaluating the total number of ED visits requiring DVHP, the Child Protection Team, or SANE consults compared to the number of ED visits with an ICD-10 code specific to these diagnoses, there were fewer ED visits compared to the number of consults, suggesting clinicians are hesitant to include ICD-10 codes indicating abuse. This demonstrates that the ICD-10 codes selected often do not fully describe concerns for assault and abuse and overall limit the ability to include all patients presenting with these complaints. However, as investigators queried the same codes from 2019 to 2020 it was assumed that the same number of patients improperly coded or miscoded would be missed from year to year. Additionally, there had not been hospital-specific training or mandates addressing these discrepancies or changes to documentation; so it is unlikely to have significantly impacted the data. Finally, patients at our ED had access to their patient portal

and full chart several years prior to our study, in 2015, and we would not expect patient access to the electronic health record to affect clinician documentation during our study period.

Following chart review, we found that a small number of patient charts coded as IPV actually described elder or familial abuse. It has been previously demonstrated in the literature that caregivers and the elderly have many of the same risks as those experiencing violence from an intimate partner.[25] As elder and familial abuse is affected by the same stressors as those contributing to other forms of abuse and these patients also require additional, sometimes overlapping resources, we included these charts under the larger umbrella of IPV. However, the extent of elder and familial abuse cases cannot be evaluated through this study, and it is unclear how much it contributed to the significant increases in ED visits for IPV.

Additionally, we had initially planned to include EMS records. However, it was discovered that specific coding for IPV, sexual assault, and child maltreatment does not currently exist and that these cases are categorized into broader, medically focused categories. While the narrative permits prehospital personnel to document occurrences in patient's words that allowed investigators to reasonably differentiate assault from IPV, this documentation in the narrative was inconsistently performed. Ultimately, assault data from EMS was removed from the study as we could not reliably compare rates of assault specific to IPV. The exception to this is in cases of strangulation where paramedics have the option to select strangulation as a diagnosis within their documentation. While the overall numbers are low, there was an increase in EMS response in which a diagnosis of strangulation was given with three cases reported in 2019 compared to 11 cases in 2020. However, a county-wide initiative involving EMS training specific to strangulation occurred in October 2019; thus, this data was ultimately thought to be too inconclusive to include in the analysis.

We purposefully included "duplicates" in this study, in the sense that we looked to potentially capture the same individual accessing multiple resources from the prehospital, hospital, and community setting. As we are comparing total numbers of calls, consults, and visits only between resources (ie, the total number of police dispatches in 2019 compared to police dispatches in 2020), we did not expect individuals accessing multiple resources to significantly affect our statistical analysis.

A final but critical limitation to recognize is the number of people who have abstained from all medical care and resources and could not be accounted for in our study. Literature has demonstrated that people have delayed and often forgone medical care during the COVID-19 pandemic. One study collected survey responses from 1337 participants and showed that 41% of responders who needed care reported forgoing medical care during this period, primarily out of fear of COVID-19 transmission and financial stresses.[24] There was a decrease in ED visits by 42% from March 29 to April 25, 2020, across the US, highest among patients who were ≤14 in age and female; this was particularly relevant to our study, which demonstrated that children and young females were at higher risk for experiencing abuse.[23] Hospitalizations for acute and life-threatening events such as heart attacks and stroke were markedly decreased in the beginning of the pandemic, which showed that even for life-threatening concerns, patients were avoiding presenting to a hospital.[22] While a percentage of these cases may be accounted for in the increased police dispatches and more refusal of care and transport to the hospital, the literature suggests there is a portion of the population experiencing abuse and assault injuries that we were unable to account for in this study.

CONCLUSION

We found increases in intimate partner violence and child maltreatment resource utilization associated with social distancing and the COVID-19 pandemic. Police calls for assault increased by 5.4% from 2019 to 2020. The percentage of ED visits for child maltreatment (0.12% to 0.17%), IPV (0.11% to 0.15%), and sexual assault (0.27% to 0.28%) also increased from 2019 to 2020, respectively, despite an overall decrease in the number of ED visits. These increases in reporting and ED visits were not reflected in the numbers found in our existing community resources. Rather, community resources including Safe Alliance and Pat's Place Child Advocacy Center saw decreases in the number of calls and referrals.

It is possible that known closures, limitations in staffing, and an inability to contact community resources safely from the home may have affected this increase in hospital and police dispatches associated with a conflicting decrease in community advocacy calls and referrals. However, further work is needed to investigate this relationship to identify and assist those experiencing violence in the home during natural disasters such as the COVID-19 pandemic and to understand how people seek out and identify community resources. The increases in types of violence experienced in the home for those using police and ED resources should be considered in disaster response and hospital planning as our response to the pandemic evolves. With children in virtual school, training for recognition of child maltreatment by teachers via a virtual platform may be needed as well as clear communication regarding availability of community resources and how to access them. Additionally, clinicians on virtual platforms and in the ED should continue to be vigilant for the signs or symptoms of intimate partner violence and child maltreatment.

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Two-point Compression Ultrasound Technique Risks Missing Isolated Femoral Vein DVTs

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Background: Deep vein thrombosis (DVT) is a common vascular problem seen in the emergency department (ED) and is commonly identified using ultrasound performed by a vascular lab, the radiology department, or at the point of care. Previous studies have assessed the utility of a two-point vs sequential technique to identify the presence of a thrombus. One particular study reported a concerning rate of isolated femoral vein thrombi that would be missed by a two-point technique.

Objectives: In this study we sought to determine whether the two-point technique misses isolated femoral vein thrombi.

Methods: We conducted a retrospective review of patients who had a new diagnosis of DVT in the ED diagnosed with vascular lab, radiology, or point-of-care ultrasound to assess for the presence and rate of thrombi that would be missed using a two-point scanning technique.

Results: We included in our study 356 patients with a diagnosis of new DVT. In our population, 21 (5.9%; 0.95 confidence interval: 3.7%, 8.9%) patients were identified with thrombi isolated to the femoral vein.

Conclusion: The two-point technique for lower extremity vascular ultrasound is insufficient for ruling out proximal DVTs in ED patients. [West J Emerg Med. 2022;23(2)597–600.]

INTRODUCTION

Deep venous thrombosis (DVT) is a common vascular problem seen in the emergency department (ED) with implications for patient morbidity or mortality if untreated.[1] Traditionally, duplex ultra-sound involving compression and Doppler techniques has been used as the safest and most effective method of identifying the presence or absence of DVT.[2] Point-of care-ultrasound (POCUS) performed by physicians at the bedside, focusing on two-dimensional (2D) compression, has been shown to be a safe and effective method of diagnosing proximal lower extremity DVTs in the ED.[3] Since publication of early literature supporting this practice, the use of POCUS for this application has grown. The American College of Emergency Physicians has included compression ultrasound in the list of core applications of bedside ultrasound that emergency physicians are able to perform.[4]

Current guidelines for duplex ultrasonography of the lower extremity recommend sequential visualization of the deep venous system with compression of the proximal greater saphenous vein, common femoral vein, femoral vein, and popliteal vein.[5] However, several studies suggest that an abbreviated two-point technique focusing on branch points around the greater saphenous junction and bifurcation of

the common femoral vein around the groin and popliteal trifurcation around the knee may be as effective as sequential compression in evaluating for DVT.[2,6] In fact, one meta-analysis indicates that the two-point technique is equivalent to sequential compression,[7] making this an attractive approach in a fast-paced environment such as the ED.

This abbreviated method of scanning, however, has raised concern for missing focal DVTs that do not extend through one of the two planes scanned using the two-point technique. Adhikari and colleagues reported a concerning number of thrombi that would be missed by the two-point technique.[8] In this study we sought to validate the findings of Adhikari et al to determine whether the two-point technique is insufficient to identify the presence of an isolated femoral vein thrombus.

Population Health Research Capsule

What do we already know about this issue?
Deep vein thrombosis (DVT) is commonly identified in the emergency department using ultrasound.

What was the research question?
Could we validate previous findings that the two-point technique misses an unacceptable rate of thrombi isolated in the femoral vein in a similar patient cohort?

What was the major finding of the study?
The two-point technique for lower extremity DVT evaluation missed 5.9% of thrombi isolated to the femoral vein.

How does this improve population health?
Understanding the test characteristics of bedside ultrasound protocols helps to improve patient care and decrease rates of morbidity and mortality.

METHODS

We conducted a single-center, retrospective study of patients presenting to the ED between 2010-2015 who had received imaging for initial diagnosis of suspected lower extremity DVT. The time period was chosen to replicate the study conditions of Adhikari et al. We performed our study in a large, urban, academic ED with an annual volume of approximately 90,000 patients with an established point-of-care ultrasound program, emergency medicine residency, and emergency ultrasound fellowship. This study was approved by the institutional review board.

We identified patients based on an *International Classification of Diseases* (ICD) query of the electronic health record. Adult patients ages ≥18 years were included if they had received imaging for suspected lower extremity DVT and were diagnosed in the ED with an acute lower extremity DVT. We also included patients identified in outpatient clinics and sent to the ED for same-day initial management of DVT. Acute lower extremity DVT was defined as a thrombus at or proximal to the popliteal vein and had not been reasonably previously identified.

The patients must have received an ultrasound either from the institution's dedicated vascular lab (images interpreted by vascular surgery), radiology department (images interpreted by radiologists), or at the bedside by trained emergency physicians or the emergency ultrasound team using standard department protocols. The standard protocol for ED-performed ultrasound in our department includes imaging the greater saphenous/common femoral vein junction, bifurcation of the common femoral vein, three locations on the femoral vein (proximal, mid, and distal), and the popliteal vein using the sequential compression technique. Both the radiology department and vascular lab use the sequential compression approach with color and spectral Doppler when evaluating the lower extremity vasculature. Calf vein findings were variably reported; thus, we did not include patients with isolated calf thrombi in our study. For the purposes of this study, the two-point technique is defined as compression ultrasound of the greater saphenous/common femoral junction region and the popliteal vein region, excluding evaluation of the common femoral vein.

The patients identified by ICD query were reviewed by participating medical students for inclusion and exclusion criteria. The ICD query searched for all patients diagnosed in the ED with an acute DVT. Patients were excluded from final analysis if the DVT was not of the lower extremity, if it was chronic or previously known, or the DVT had been diagnosed later in the patient's hospital course (not in the ED). For those patients included in the final analysis, we reviewed the imaging reports for the location of the clot in the lower extremity.

We recorded the presence of thrombus at the distal external iliac vein, greater saphenous vein \, common femoral vein (, proximal femoral vein, mid femoral vein, distal femoral vein, and popliteal vein . Uncertain findings were adjudicated by three members of the study team (MT, DG and RJ). Findings were recorded on a deidentified Excel spreadsheet (Microsoft Corp., Redmond, WA) spreadsheet for data analysis. We calculated confidence intervals (CI) using an online calculator found at https://sample-size.net/confidence-interval-proportion.

RESULTS

The initial ICD query resulted in 1,493 patient events. After review of the health records we excluded 1,137 patients

who did not meet the inclusion criteria for the following reasons: no DVT was identified; the DVT had been diagnosed later in the hospital course; or the patient had chronic DVT, non-lower extremity DVT, or previously known DVT. A total of 356 patients met inclusion criteria and were included in the final analysis. The mean age of the included patients was 53 with a standard deviation of 15.

The proportion of studies performed by the ED ultrasound team, the radiology department, and the vascular lab are shown in Table 1. Of the 356 with an acute isolated lower extremity DVT, most were found to extend across more than one section of the lower extremity as shown in Table 2. The most common location was a thrombus extending from the proximal femoral vein through the popliteal vein. Isolated thrombi were found in each of the vein segments of interest. The rates of isolated thrombi in each of the vein segments are shown in Table 3. The most common location for an isolated thrombus was in the popliteal vein (18%, 0.95 CI: 14.1%, 22.4%) followed by the femoral vein (5.9%, 0.95 CI: 3.7%, 8.9%).

Table 1. Proportion of studies performed in each department to identify deep vein thromboses.

Performing department	Percentage of studies (N)
ED POCUS	12.4% (44)
Radiology	39.3% (140)
Vascular Lab	48.3% (172)

ED, emergency department; *POCUS,* point-of-care ultrasound.

Table 2. Number and rate of lower extremity thrombi spanning multiple regions of the deep leg veins.

Thrombus location	Percentage (N)	95% Confidence interval
DEI-POP	15.5% (55)	11.9 - 19.6%
DEI-FVd	3.4% (12)	1.8 - 5.8%
CFV-POP	12.6% (45)	9.4 - 16.6%
CFV-FVd	3.7% (13)	2.0 - 6.2%
FVp-POP	28.1% (100)	23.5 - 33.1%

DEI, distal external iliac; *CFV,* common femoral vein; *FVp,* proximal femoral vein; *FVd,* distal femoral vein; *POP,* popliteal vein.

Table 3. Number and rate of isolated lower extremity thrombi.

Isolated thrombus location	Percentage (N)	95% Confidence interval
DEI	0.6% (2)	0.7 - 2.0%
CFV	2.3% (8)	1.0 - 4.4%
GSV	2.5% (9)	1.2 - 4.7%
DFV	0.6% (2)	0.7 - 2.0%
FV (P/M/D)	5.9% (21)	3.7 - 8.9%
POP	18.0% (64)	14.1 - 22.4%

DEI, distal external iliac; *CFV,* common femoral vein; *GSV,* greater saphenous vein; *DFV,* deep femoral vein; *FV,* proximal femoral vein (proximal, mid or distal); *POP,* popliteal vein.

DISCUSSION

The use of two-point vs sequential technique when evaluating for DVT has been a point of discussion for POCUS users with proponents arguing that DVTs most commonly occur at branch points, extend through multiple segments, or would be otherwise recognized based on sonographic factors other than compression (ie, alterations in Doppler flow). Given the importance of the findings of Adhikari et al on POCUS DVT ultrasound workflow, we sought to validate previous findings that identified a significant rate of isolated thrombi in areas that would be missed when strictly using the two-point technique for DVT evaluation. In 2014, Adhikari and colleagues conducted a retrospective review of patients seen in their ED over a five-year period who had a comprehensive ultrasound of the lower extremity and had been diagnosed with a DVT. In their analysis they identified 2451 patients who had undergone duplex ultrasound evaluation with DVTs identified in 362 of those patients. Of those 362 patients, 20 (5.5%) had thrombi isolated to the femoral vein and three (0.8%) had thrombi isolated to the deep femoral vein.

The utility and safety of the two-point technique was then called into question, leading to dis-cussion on the most efficient and appropriate way to conduct this exam at the bedside.[8] The vast majority of patients in our study had thrombi that traversed through multiple zones (popliteal, femoral, common femoral, etc). Specifically, we noted that the rate of isolated femoral vein thrombus and isolated deep femoral vein thrombus was similar to that found by Adhikari. Our data on the number of isolated DVTs that could be missed by the two-point technique highlights the external validity of their observations.

Previous literature has shown that direct visualization of a patent vessel as demonstrated by com-pression in a sequential analysis is a reliable way of evaluating for DVT in the ED.[2,9,10] Doppler is often used in radiology departments and vascular labs, in addition to direct compression to assess for filling defects and direct or augmented flow alterations due to thrombi located outside the area of direct visualization. Demonstration of a filling defect can be easily over- or under-demonstrated with inappropriate Doppler settings. Doppler flow alterations, which are predicated on the presumption that a thrombus

is occlusive, have not been shown to identify thrombi that were not previously visualized with compression ultrasound.[11] Thus, quality sequential 2D compression ultrasonography is vitally important, especially for non-occlusive thrombi.

Based on our data, we believe that strict adherence to the two-point technique is insufficient to adequately evaluate the proximal vessels of the lower extremity for DVT. We believe that POCUS sonographers should perform sequential compression of the proximal leg veins that includes the femoral vein.

LIMITATIONS

Our study does have several limitations. While we sought to replicate the methods of the Adhikari study (including a similar five-year window), there were several differences that need to be acknowledged when interpreting our results. First, this was a single-center study with ultrasounds performed by emergency physicians, the radiology department, or the vascular lab in an effort to ensure capture of as many patients as possible who had been diagnosed with DVT. Thus, there were several formats of reporting that required interpretation or confirmation by the study team. Questions regarding reporting language discrepancy were confirmed by a registered vascular technologist sonographer dedicated to the ED or by an attending physician trained and privileged in bedside ultrasound.

Second, this analysis was a retrospective study in which patients were found by searching through a database by ICD codes. Thus, patient identification was dependent on proper input of ICD codes by coders based on ED diagnosis. Patients improperly coded would thereby not be identified. However, we did include in our analysis patients who were originally missed but identified by ICD on subse-quent visits to maintain reasonable accuracy in patient inclusion.

Finally, like the comparison study that we sought to validate, we conducted a retrospective analysis of ultrasound studies using the sequential compression technique. We visualized the location of the thrombi in the various portions of the proximal leg and extrapolated that the presence of an isolated thrombus in the femoral vein would result in a missed DVT using the two-point compression technique. While this is likely true when performing a limited DVT ultrasound in the ED using compression as the method to identify thrombi, it does not account for flow alterations that may be visualized with Doppler proximal to the site of a thrombus. Since routine use of Doppler is not typically performed in ED ultrasound, this was not assessed in our study. For these reasons, further analysis in a prospective manner would be warranted.

CONCLUSION

Our results demonstrate that the two-point technique for lower extremity vascular ultrasound is insufficient for ruling out proximal DVTs in ED patients. A prospective analysis of two-point vs sequential compression would be warranted to confirm these findings.

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