

Dedicated Shift Wrap-up Time Does Not Improve Resident Sign-out Volume or Efficiency

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Supervising Section Editor: Gene Hern Jr., MD

Submission history: Submitted April 29, 2009; Revision Received August 2, 2009; Accepted August 22, 2009

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Objectives: Sign-out (SO) is a challenge to the emergency physician. Some training programs have instituted overlapping 9-hour shifts. The residents see patients for eight hours, and have one hour of wrap-up time. This hour helps them complete patient care, leaving fewer patients to sign-out. We examined whether this strategy impacts SO burden.

Methods: This is a retrospective review of patients evaluated by emergency medicine (EM) residents working 9-hour (eight hours of patient care, one hour wrap-up time) and 12-hour shifts (12 hours patient care, no reserved time for wrap-up). Data were collected by reviewing the clinical tracker. A patient was assigned to the resident who initiated care and dictated the chart. SO was defined as any patient in the ED without disposition at change of shift. Patient turn-around-time (TAT) was also recorded.

Results: One-hundred sixty-one postgraduate-year-one resident (PGY1), 264 postgraduate-year-two resident (PGY2), and 193 postgraduate-year-three resident (PGY3) shifts were included. PGY1s signed out 1.9 patients per 12-hour shift. PGY2s signed out 2.3 patients on 12-hour shifts and 1.8 patients on 9-hour shifts. PGY3s signed out 2.1 patients on 12-hour shifts and 2.0 patients on 9-hour shifts. When we controlled for patients seen per hour, SO burden was constant by class regardless of shift length, with PGY2s signing out 18% of patients seen compared to 15% for PGY3s. PGY1s signed out 18% of patients seen. TAT for patients seen by PGY1s and PGY2s was similar, at 189 and 187 minutes, respectively. TAT for patients seen by PGY3s was significantly less at 175 minutes.

Conclusion: The additional hour devoted to wrapping up patients in the ED had no affect on SO burden. The SO burden represented a fixed percentage of the total number of patients seen by the residents. PGY3s sign-out a smaller percentage of patients seen compared to other classes, and have faster TATs. [West J Emerg Med. 2010; 11(1):35-39].

INTRODUCTION

Shift work is inherent to emergency medicine (EM) practice and is becoming more common in other disciplines, as many centers switch to a hospitalist-based admission system. Inherent to any shift-based medical system is the need to transfer care of patients to new providers at change of shift. It has been noted in the literature that overlapping shifts might help reduce the sign-out (SO) burden by allowing

physicians the opportunity to wrap up patients and have fewer undispositioned patients at change of shift;¹ however, the impact of this shift paradigm on SO burden has not been studied.

We sought to determine whether there is any difference in SO burden by post-graduate year (PGY) among PGY1s, PGY2s, and PGY3s. We also studied differences in SO burden from PGY2s and PGY3s working 12-hour versus 9-hour

shifts, with an hour of shift overlap specifically dedicated to wrapping up existing patients. Since SO burden is partly determined by the number of patients seen by each resident and partly determined by the turn-around time (TAT) of each patient seen, we collected these data points for each class, as well. We hypothesized that residents would sign out fewer patients on 9-hour shifts compared to 12-hour shifts because the additional hour of wrap-up time would allow residents to disposition more patients prior to shift termination. We also hypothesized that residents of more advanced training would sign out fewer patients than residents with less training, as we expected they would have shorter TATs as a function of their higher level of experience.

METHODS

This is a retrospective chart review of patients evaluated by EM residents in an urban tertiary care referral center. The emergency department (ED) has 45 beds with an annual volume of 65,000. The study period was three consecutive months beginning November 1, 2006. This time period was chosen to avoid the summer, when residents are adjusting to their new roles, as well as the spring, when residents are allowed to trade shifts with those of different levels of training. All EM residency shifts during the study period were included. Shifts were a combination of 9-hour shifts (7am – 4pm, 3pm – 12am, and 11pm – 8am) and 12-hour shifts (7am – 7pm, 8am – 8pm, 9am – 9pm, 1am – 1pm, 2pm – 2am, 7pm – 7am, and 8pm – 8am). All residents working 9-hour shifts are expected to see new patients for eight hours and devote their last hour to wrapping up existing patients. They are aware of this expectation, which is reinforced as part of their ED orientation. During the study period, no resident working a 9-hour shift initiated care on a patient in the last hour of his shift. PGY1s only worked 12-hour shifts, while PGY2s and PGY3s worked a combination of shift lengths. Shifts worked by off-service residents were excluded. We also excluded shifts worked on the weekly conference days, as residents work shifts of differing lengths compared to the rest of the week and because there is a different proportion of attending physician and physician assistant coverage on those days.

We collected data by review of the clinical tracker (VitalWorks version 2.7.2, modified 4/26/05), which creates a permanent electronic record of time of resident assignment and time of patient disposition. The difference between these times was defined as the TAT. We did not use time-to-bed assignment or time-to-removal of the patient name from the tracker for our data collection, as these items are based upon bed availability and secretarial work-load, which are parameters beyond the residents' control. We checked data against the patient's medical record and the residents' work schedule to verify the provider assigned to the patient. A patient was assigned to a resident if the resident initiated care on the patient and dictated the chart. Ten percent of

the data was collected by a second data abstractor, with an interobserver reliability of 97% for identification of both the specific resident assigned to the patient and for time of patient care initiation. When patients were in the ED through multiple shifts and cared for by multiple providers, the resident who first initiated care and dictated the chart was credited with that given patient and that patient's TAT.

SO burden was defined as the number of patients remaining in the ED with no disposition at change of shift. Change of shift was defined as the pre-determined time at which a provider is scheduled to end his clinical shift. SO burden and TAT by shift length were examined by two-tailed T test, and ANOVA was used to assess SO burden and TAT by resident training level. Trained data abstractors entered data into a standardized spreadsheet. The study protocol was reviewed by the institutional review board and found to be exempt.

RESULTS

A total of 161 PGY1 shifts (all twelve-hour shifts), 264 PGY2 shifts (101 twelve-hour shifts, 163 nine-hour shifts), and 193 PGY3 shifts (156 twelve-hour shifts, 37 nine-hour shifts) were included. PGY1s signed out an average of 1.9 patients per twelve-hour shift. PGY2s signed out an average of 2.3 patients on twelve-hour shifts and 1.8 patients on nine-hour shifts ($p = 0.004$). PGY3s signed out an average of 2.1 patients on twelve-hour shifts and 2.0 patients on nine-hour shifts ($p = 0.45$). When we controlled for the volume of patients seen per hour during the course of a shift, SO burden was constant for PGY2s and PGY3s respectively, regardless of shift length. In other words, PGY2s saw more patients per hour during their shorter shifts, and this accounted for the increased SO burden on the shorter shifts. PGY2s signed out 18% of the patients they saw ($p = 0.91$ between different shift lengths) and saw 1.13 patients per hour. PGY3s, on the other hand, signed out 15% of the patients they saw, and saw 1.25 patients per hour. There was no significant difference between the percentage of patients SO on 12-hour compared to 9-hour shifts for PGY3s ($p = 0.08$). The difference between percentage of patients signed out by PGY3s and PGY2s was statistically significant ($p = 0.005$), although the total number was not. PGY1s signed out 18% of the patients they saw, and saw 0.85 patients per hour. Residents working 12-hour shifts reported staying an average of 60 minutes beyond the end of their shift, while residents working 9-hour shifts reported staying on average about 30 minutes late. There was a wide range of overtime described by residents, with some residents reporting staying two hours late regardless of shift length and others reporting leaving within 15 minutes. However, the majority reported staying later after longer shifts than shorter shifts.

TAT for patients seen by PGY1s was 189 minutes (95 percent confidence interval, 7 minutes). TAT for patients seen

by PGY2s was similar, at 187 minutes (95 percent confidence interval, 5 minutes). TAT for patients seen by PGY3s was significantly less at 175 minutes (95 percent confidence interval, 5 minutes, $p < 0.01$). For PGY2s and PGY3s, there was no statistically significant difference in TAT for 9-hour compared to 12-hour shifts.

DISCUSSION

The Joint Commission for the Accreditation of Healthcare Organizations made better communication between medical providers at patient sign-out a National Patient Safety Goal in 2006.² The evidence that there is room for improvement in inter-provider communication is well supported in the literature. Incomplete communication between providers in the inpatient and outpatient setting has been shown to be both common and deleterious to patient care.³ Because of work-hour restrictions, SO between house officers in the inpatient setting is becoming more frequent, but few programs have standardized the SO process or provide training in appropriate SO procedures,^{4,5} and patients are more likely to suffer an adverse event after SO to a new provider.^{6,7} This is compounded by incomplete attending-level supervision, since attendings are often not present during SO and housestaff may be unable to effectively communicate or understand the critical issues regarding a given patient's care.^{5,8} The surgical literature identifies miscommunication at SO as being an integral contributor to medical errors.⁹ Although there is a growing body of research regarding how to make SO safer, more complete, and more effective,^{1,5, 10-15} SO continues to be a high-risk time in patient care, as information may be lost that results in medical errors and near misses.^{11,16-19} Therefore, in addition to seeking to make the SO process safe, standardized and comprehensive, it is also desirable to limit the number of patients signed out each day. Data on EM provider satisfaction have led many training programs to reduce the length of shifts worked,²⁰⁻²³ which intuitively leads one to think that more patients will be signed out each day, as there are more total daily shifts for the same provider coverage. For example, an ED that utilizes 12-hour shifts with two SO per day should sign out fewer total patients during the course of a day than an ED that utilizes 8- or 6-hour shifts with three or four sign-outs per day. A reasonable solution to this is to provide residents with scheduled time during a shift to disposition existing patients while having no responsibility for seeing new patients. This is the reasoning behind 9-hour overlapping shifts.

Our study did not find any evidence to support this practice as a means of reducing SO burden. The additional hour devoted to wrapping up existing patients in the ED had no effect on the number of patients signed out at change of shift. For PGY2s, the SO burden was higher after shorter

shifts than longer shifts, and for PGY3s, the number was the same. Instead, we found that PGY2s and PGY3s signed out a fixed percentage of the total patients they saw, and they saw more patients per hour on the shorter shifts. Indeed, staffing the ED with residents working nine-hour shifts would result in more total patients signed out in a 24-hour period, compared to staffing with residents working 12-hour shifts. It is unclear why this occurred. It is possible that residents working 12-hour shifts see fewer new patients in the last hour of their clinical shifts, thereby giving themselves time to finish up patients from the first 11 hours. This would mimic the built-in hour at the end of the 9-hour shifts, which is devoted simply to patient wrap up. It may also be that residents working 9-hour shifts signout the same total number of patients, but their SO may be more complete and more "tidied up" than residents working 12-hour shifts. An additional reason for this phenomenon might be that residents working 12-hour shifts pick up lower acuity complaints near the end of their shifts, while those working 9-hour shifts continue to pick up higher acuity complaints with the anticipation of an hour to complete care.

The ability to multi-task and work efficiently is an important goal of EM training. In our study, PGY3s saw more patients and dispositioned them more quickly than their counterparts who had completed less training. This is probably because of their increased experience and ability to act independently in a clinical setting. The improved ability to see patients per hour as residents progress through the course of training has been well documented in the literature,²⁴⁻²⁸ and one study has shown that PGY1s have longer TATs than PGY2s and PGY3s.²⁴ Although our study period intentionally began five months into the academic year so that PGY1s would have become oriented to their roles as resident physicians, we believe that less experienced providers are possibly less facile at navigating any hospital system. It is also possible that as residents spend more time in a given hospital, they develop interpersonal relationships with consultants, nurses, clerical staff, and other residents, which may help facilitate patient disposition. Ultimately, it can be argued whether a decrease in TAT by 12 minutes between PGY2s and PGY3s is clinically significant or merely statistically significant. Twelve minutes for a single patient encounter may not make a significant difference in patient flow in a busy ED, but the same 12 minutes could potentially be very consequential on the larger scale of dozens of patients seen by residents each day.

Most likely, it is this increased efficiency that led to PGY3s having a lower SO burden at the end of their shifts when compared to PGY2s and PGY1s. Additionally, PGY3s may be better able to anticipate the end of their shifts and assess the level of complexity of new patients, leading them to choose patients with straightforward dispositions and resulting in a lower SO burden.

LIMITATIONS

There are a number of limitations with our study. We were unable to control for patient acuity, as the electronic tracking system utilized for data acquisition did not record triage levels during the study period. This is important, as higher acuity or more complex patients may sometimes (but certainly not always) take longer to disposition than lower acuity patients. This could result in changes in TAT and SO burden. At another institution, it was shown that PGY3s see lower acuity patients than PGY2s or PGY1s.²⁴ It is unknown if this is generalizable to our resident population. However, PGY2s at our institution are more commonly assigned to “trauma” shifts, which are 12-hour shifts from 8 am to 8 pm and 8 pm to 8 am during which they are responsible for procedures on trauma patients, and this could conceivably impact those residents’ TATs and SO burden. The impact of this should be small, however, since other residents often care for trauma patients, and there are no other clearly defined patient type to which residents are assigned.

There was no way to quantify the quality of SO. In other words, there was no way to determine how concise, complete, or error-free each SO was by residents of varying levels or working different length shifts. We likewise could not find a reliable way to determine the number of procedures signed out. This is significant, because the SO burden, defined as the number of patients remaining with no disposition, may be less or more of a work-load to a provider starting his clinical shift depending on the complexity and further workup involved with the patient. Indeed, a SO involving a single poorly understood patient with incomplete information can result in an incoming provider’s inability to see new patients or attend to other work; whereas a SO involving many patients that is complete and focused may interfere very little with seeing new patients.

Another possible limitation is that we did not look at patient length of stay (LOS), or time from triage to disposition. We only looked at the time in which residents were directly involved in patients’ care. Therefore, we cannot address the rapidity with which residents pick up waiting patients. We also cannot state whether residents of different levels of training or working different length shifts contribute differently to patient total LOS. For instance, it may be that PGY2s and PGY1s have the same patient TATs, but one of those classes may see waiting patients more rapidly and therefore have decreased total ED LOS. We did not undertake this assessment because it relies heavily on when patients are placed in rooms to be seen, and residents have little control over this portion of the patient’s timeline in their ED.

Finally, our data were drawn from a single institution, and may not be generalizable to other institutions. Our ED LOS averages 180 minutes for discharged patients, and our overall

boarding times are 7.5 hours for admitted patients. This is lower than the national average and may speak to systems issues that are unique to our institution.

CONCLUSION

Shifts with a built-in hour for wrapping up existing patients did not result in a reduction of SO burden. Instead, the number of patients signed out represented a fixed percentage of the total number of patients seen by PGY2s and PGY3s. This may be because of end-of-shift behavior differences in residents working 12-hour versus 9-hour shifts. PGY3s saw more patients and signed out a smaller percentage of patients seen compared to other classes.

PGY3s have faster patient TATs than PGY2s or PGY1s. PGY2s and PGY1s have the same TATs, but PGY2s see more patients during the course of their shifts. There was no difference in TAT for PGY2s or PGY3s as a function of their shift length.

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Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources, and financial or management relationships that could be perceived as potential sources of bias. The authors disclosed none.

REFERENCES

1. Lawrence RH, Tomolo AM, Garlisi AP, et al. Conceptualizing handover strategies at change of shift in the emergency department: a grounded theory study. *BMC Health Serv Res*. 2008; 8: 256.
2. 2006 Critical Access Hospital and Hospital National Patient Safety Goals Joint commission for the accreditation of healthcare organizations website. January 20, 2006, Available at: http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals/06_npsg_cah.htm. Accessed February 3, 2010.
3. Kripalani S, LeFevre F, Phillips CO, et al. Deficits in communication and information transfer between hospital-based and primary care physicians. *JAMA* 2007; 297(8): 831-41.
4. Horwitz LI, Krumholz HM, Green ML, et al. Transfers of patient care between house staff on internal medicine wards. *Arch Intern Med*. 2006; 166(11): 1173-7.
5. Sinha M, Shriki J, Salness R, et al. Need for standardized sign-out in the emergency department: a survey of emergency medicine residency and pediatric emergency medicine fellowship program directors. *Acad Emerg Med*. 2007; 14(2): 192-6.
6. Petersen LA, Brennan TA, O’Neil AC, et al. Does housestaff discontinuity of care increase the risk for preventable adverse events? *Ann Intern Med*. 1994; 121(11): 866-72.

7. Gandhi TK. Fumbled handoffs: one dropped ball after another. *Ann Intern Med.* 2005; 142(5): 352-8.
8. Shojania KG, Fletcher KE, Saint S. Graduate medical education and patient safety: a busy—and occasionally hazardous—interaction. *Ann Intern Med.* 2006; 145(8): 592-8.
9. Williams RG, Silverman R, Schwirnd C, et al. Surgeon information transfer and communication; factors affecting quality and efficiency of inpatient care. *Ann Surg.* 2007; 245(2): 159-69.
10. Arora V, Johnson J, Lovinger D, et al. Communication failures in patient sign-out and suggestions for improvement: a critical incidence analysis. *Qual Saf Health Care.* 2005; 14(6): 401-7
11. Patterson ES, Roth EM, Woods DD, et al. Handoff strategies in settings with consequences for failure: lessons for health care operations. *Internat J Qual Health Care.* 2004; 16: 125-132.
12. Van Eaton EG, Horvath KD, Lober WB, et al. Organizing the transfer of patient care information: the development of a computerized resident sign-out system. *Surgery.* 2004; 136(1): 5-13.
13. Vidyarthi AR, Arora V, Schnipper JL, et al. Managing discontinuity in academic medical centers: strategies for a safe and effective resident sign-out. *J Hosp Med* 2006; 1(4): 257-66.
14. Catchpole KR, deLeval MR, McEwan A, et al. Patient handover form surgery to intensive care: using Formula 1 pit-stop and aviation models to improve safety and quality. *Pediatr Anaesth.* 2007; 17(5): 470-8.
15. Arora V, Johnson J. A model for building a standardized hand-off protocol. *Jt Comm J Qual Patient Saf.* 2006; 32(11): 646-55.
16. Ye K, McD Taylor D, Knott JC, et al. Handover in the emergency department: Deficiencies and adverse effects. *Emerg Med Austral.* 2007; 19:433-441.
17. Laxmisan A, Hakimzada F, Sayan OR, et al. The multitasking clinician: decision-making and cognitive demand during and after team handoffs in emergency care. *Int J Med Inform..* 2007; 76(11-12): 801-811.
18. Horwitz LI, Meredith T, Schuur JD, et al. Dropping the baton: a qualitative analysis of failures during the transition from emergency department to inpatient care. *Ann Emerg Med.* 2009; 53(6): 701-10.
19. Kitch BT, Cooper JB, Zapol WM, et al. Handoffs causing patient harm: a survey of medical and surgical house staff. *Jt Comm J Qual Patient Saf.* 2008; 34(10): 563-70.
20. Fitzpatrick JM, White AE, et al. Shift work and its impact upon nurse performance: current knowledge and research issues. *J Adv Nurs.* 1999;29(1): 18-27.
21. Steele MT, Watson WA. Emergency medicine residency faculty scheduling: Current practice and recent changes. *Ann Emerg Med.* 1995; 25: 321-324.
22. Whitehead DC, Thomas H Jr, et al. A rational approach to shiftwork in emergency medicine. *Ann Emerg Med.* 1992; 21(10): 1250-1258.
23. Thomas H Jr Schwartz E, Slapper DR. Eight- vs. 12-hour shifts: Implications for Emergency Physicians. *Ann Emerg Med.* 1994; 23(5):1096-1100.
24. DeBehnke D, Obrien S, et al. Emergency Medicine Resident Work Productivity in an Academic Emergency Department. *Acad Emerg Med.* 2000; 7(1): 90-2.
25. Brennan DF, Silvestri S, et al. Progression of Emergency Medicine Resident Productivity. *Acad Emerg Med.* 2007; 14(9): 790-4.
26. Deveau JP, Lorenz JE, et al. Emergency Medicine Work Productivity and Procedural Accomplishment. *J Amer Osteo Assoc.* 2003; 103(6): 291-6.
27. Dowd MD, Tarantino C, et al. Resident efficiency in a pediatric emergency department. *Acad Emerg Med.* 2005; 12: 1240-4.
28. Jeanmonod R, Brook C, et al. Resident productivity as a function of emergency department volume, shift time of day, and cumulative work time. *Am J Emerg Med.* 2009; 27(3): 313-9.