ORIGINAL ARTICLE

The impact of a universal admission order on health system capacity

Kraftin Ellice Schreyer*[1], Jack Allan[1], Michele Jones[2], Daniel A. DelPortal[1]

[1] *Department of Emergency Medicine, Temple University Health System, Philadelphia, PA, United States*
[2] *Department of Nursing, Temple University Health System, Philadelphia, PA, United States*

Received: May 8, 2023 **Accepted:** July 9, 2023 **Online Published:** July 25, 2023
DOI: 10.5430/jha.v12n2p6 **URL:** https://doi.org/10.5430/jha.v12n2p6

ABSTRACT

In our health system with multiple campuses, a universal admissions order (UAO) was introduced to further improve patient flow. We hypothesized that the UAO would more evenly distribute health system capacity, with an increase in admissions to the community affiliate sites. Inpatient and emergency department (ED) metrics were evaluated, and included total admissions, admissions to each clinical site from each ED, the time to the inpatient bed being ready to receive the ED patient, boarding times, and the left without being seen rate. After implementation of the UAO, the average time to inpatient beds being ready to accept ED patients decreased at all three clinical sites by an average of 25 minutes. Admissions were more evenly distributed amongst the three clinical sites, with 3% of all admissions admitted to a new campus. While there were likely other variables at play, there was system-wide reduction in the time to inpatient beds being ready to accept ED patients, and an improvement in boarding at the main clinical site. Our work suggests that a UAO could be a useful adjunct to central capacity management in a health system with multiple clinical campuses.

Key Words: Capacity, Admission, Flow, Health system, Standardization

1. INTRODUCTION

Emergency department (ED) crowding, defined as demand for emergency services in excess of available resources, has been a problem for decades, but is worsening as of late.[1,2] Crowding inevitably leads to delays in care, for patients admitted to the hospital, those that are to be discharged, and those waiting to be seen in the ED.[1,3] It is intertwined with ED boarding, which occurs when patients admitted to the hospital remain in the ED while awaiting transfer to an inpatient unit.[2,4] Crowding, and the subsequent increases in waiting times and delays in care, have long been linked to patient safety concerns, including increased medical errors, inability to maintain patient privacy, as well as increased morbidity and mortality.[1,2,5] Boarding, in particular, has been linked to increased inpatient length of stay and mortality.[6–8] Additionally, crowding has been linked to decreases in patient and provider satisfaction, which can also contribute to lower quality care.[2]

For years, crowding and boarding were thought to be ED-centric issues, and thus, improvement efforts directed towards crowding and boarding were often the sole responsibility of ED leadership.[4] Yet, ED driven interventions, including solutions targeting the input and throughput phases of ED flow, have not solved the problem.[4,9] It has since been recognized that crowding and boarding are the result of upstream issues within a hospital and health system and are more likely to occur when hospital capacity exceeds 85 to 90%.[1,8,10,11] Successful interventions to reduce ED crowd-

*Correspondence: Kraftin Ellice Schreyer; Email: Kraftin.schreyer@tuhs.temple.edu; Address: Dept. of Emergency Medicine, Temple University Hospital. 1006 Jones Hall, 1316 W. Ontario Street, Philadelphia, PA 19140, United States.

ing and boarding, must therefore, focus on processes and factors external to the ED proper.

Hospital and health-based initiatives have proven to be successful in reducing ED crowding and boarding. The Institute for Healthcare Improvement identified specific areas to target for improvement of patient flow along the entire flow spectrum. This included several key areas of focus including transfer of patients from the ED to inpatient units, transfer of patients from intensive care units to medical floors, and smoothing of the surgical schedule.[12] Johnson and Capasso also highlighted the need to focus on the entire patient flow spectrum, including both admissions and discharge processes, such as use of a discharge lounge.[13]

Multiple studies have also identified communication as a major barrier to efficient flow between the ED and inpatient units.[12,14–16] Others have further specified that optimal communication and coordination should come in the form of a central bed manager or centralized bed management system.[10,17–20] Barrett et al. described a "bed manager" whose role was to identify and assign inpatient beds while maintaining communication about census status to key parties, which included overseeing a daily bed status meeting.[18] Resar et al introduced a Real-Time Demand Capacity Management system, whereas Lovett et al reported success from implementation of a Patient Flow Management Center, which centralized bed management across three hospitals within a health system.[16,19] These centralized bed management programs have been shown to have a positive impact on key ED metrics such as evaluation times, walkouts, and ambulance diversion, along with reductions in inpatient length of stay.[19,20]

Our health system implemented a capacity center, "Bed-X" in 2019. However, the capacity center oversaw bed placement at only one hospital in a three-hospital health system. Furthermore, admissions processes were slightly different at each clinical site. This often led to overfilling of the main clinical site, and underfilling of two community affiliate sites. To further improve patient flow by more appropriately distributing capacity throughout the health system, a universal admissions order (UAO) was introduced in 2022. Here, we evaluate the order for its impact on ED and inpatient flow. The aims of this quality improvement project using the UAO intervention were to positively impact the ED metrics and admit patients to the most appropriate bed in the three-hospital system.

2. METHODS

The study health system is made up of four hospitals, three of which have their own EDs. In this analysis, three of the four hospitals were included, as they were on the same electronic medical record. The three hospitals studies include a main, urban, academic center (Site A), a suburban community affiliate (Site B) and an urban community affiliate (Site C). Site A is a 595-bed quaternary care center, with an annual ED volume of 85,000 visits. Of the inpatient beds, 107 are dedicated ICU beds, although 11 of those are in an infant intensive care unit. Site B is a 176-bed hospital with 10 dedicated ICU beds, and an annual ED volume of 36,000 visits. Site C is primarily a behavioral health hospital, with only 21 inpatient medical beds and no ICU beds. The annual ED volume at Site C is 34,000 visits.

Since August of 2019, Site A has used a central bed planning capacity center, "Bed X" for placement of admitted patients. The center houses of a patient placement coordinator (a registered nurse responsible for bed assignment), a team assigner (a registrar responsible for assigning patients to inpatient teams), and leadership from nursing, environmental services, and transportation. The capacity center is overseen by a nurse-physician dyad.

On May 17th, 2022, the oversight of the capacity center was extended to include all three clinical sites. This expansion was facilitated by a Universal Admission Order (UAO). The order, built into the electronic medical record (EMR), incorporated site-specific admissions criteria, which automatically determined the appropriateness of each site for inpatient admission. The patient placement coordinator then reviewed the results of the admissions order and bedded the patient at the most appropriate campus based on health system capacity. If a patient was appropriate for only one campus, they were bedded there, but if patients were appropriate for more than one campus, they were bedded at the campus with the most available beds. All three clinical sites used the UAO, which eliminated previous variations in the admissions process.

All data were extracted from our EMR, EPIC, developed by Epic Systems Corporation (Verona, Wisconsin). Data was obtained for four months before (defined as the pre-intervention period) and four months after (defined as the post-intervention period) implementation of the UAO. The month the UAO was introduced was intentionally removed from analyses to account for the transition. Inpatient metrics included total admissions, admissions to each clinical site from each ED and the time to the inpatient bed being ready to receive the ED patient. The inpatient bed being ready necessitated both an available bed and for that bed to be cleaned. ED metrics included boarding times, defined in accordance with JCAHO standards as the percentage of admissions holding in the ED for greater than 4 hours (r3 report), and the left without being seen (LWBS) rate as a

percentage of total ED visits. Pre-intervention metrics were compared to post-intervention using two sample *t*-tests.

This study was not considered human subjects research, and therefore did not require IRB review.

3. RESULTS

Results are summarized in Table 1 and Table 2. A total of 11,388 patients were admitted in the pre-intervention period, compared to 11,536 patients in the post-intervention period. The fluctuation in total admissions at each clinical site between the pre-intervention and post-intervention period were not clinically or statistically significant. Monthly admissions to Site A decreased from an average of 1659 to 1650 patients per month. Average monthly admissions to Site B and Site C increased by 27 and 19 patients per month, respectively. Average monthly admissions from Site A increased from zero to 57 patients per month at Site B and from zero to 11 patients per month at Site C. Monthly admissions from Site B to Site A increased from 19 to 24 on average per month.

The time to an inpatient bed being ready to receive an ED patient decreased from an average of 184 minutes to an average of 160 minutes at Site A, from an average of 63 minutes to an average of 55 minutes at Site B, and from an average of 164 minutes to an average of 122 minutes at Site C. No changes in time from the pre-intervention period to the post-intervention period reached statistical significance.

Table 1. Inpatient and Emergency Department Metrics pre- and post-intervention

Metric	Pre-Intervention	Post-Intervention	*p*-value
INPATIENT			
Total Admissions (#)	11,388	11,536	
Site A	6,635	6,599	.90
Site B	2,694	2,802	.40
Site C	2,059	2,135	.62
Time to Inpatient Bed Ready (min)			
Site A	184	160	.22
Site B	63	55	.18
Site C	164	122	.07
EMERGENCY DEPARTMENT			
Boarding Times (%)			
Site A	41	36	.18
Site B	5	7	.37
Site C	47	47	.93
Left Without Being Seen (%)			
Site A	27	29	.52
Site B	4	6	.31
Site C	6	6	.99

Note. As shown in Table 1, total admissions reported as a number (#). Time to inpatient bed reported as an average of minutes (min). Boarding times reported as a monthly average of the percent of admissions waiting in the ED over 4 hours from the time of admission order (%). Left without being seen reported as a monthly average of the percent of arrivals leaving before being seen by an ED clinician or provider (%).

Table 2. Intercampus admissions pre- and post-intervention

	Site A		Site B		Site C	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Site A	5,554	5,622	0	170	0	34
Site B	75	96	2,468	2,546	0	1
Site C	1,201	1,399	543	510	304	219

Note. As shown in Table 2, values reported as absolute numbers of admissions.

ED boarding decreased by 5% at Site A on average each month in the post-intervention period. Boarding increased at Site B by a monthly average of 2%. Boarding remained unchanged at Site C. The LWBS rate increased by 2% at both Site A and Site B. At Site C, the LWBS rate was unchanged. No changes in boarding or LWBS percentages reached statistical significance from the pre-intervention period to the post-intervention period.

4. DISCUSSION

Emergency Department (ED) overcrowding is a widely accepted patient safety issue that has garnered much attention and effort toward various improvement processes.[2,5,7,9] While there is invariability in patients and health care providers, standardization of health care processes that removes variability has the potential to improve efficiencies and outcomes.[21] In our health system, we implemented a UAO to reduce variation in the admissions process and more appropriately distribute health system capacity. Overall, the UAO positively impacted the distribution of capacity across three clinical sites. Centralized bed placement teams have previously been identified, but, to our knowledge, this type of standardized admission order has not previously been evaluated.[14,18,19]

The average time to inpatient beds being ready to accept ED patients decreased at all three clinical sites by an average of 25 minutes. The improvement at Site C, in particular, neared statistical significance. While this time includes the time from the ED admission order to the inpatient bed assignment and from the inpatient bed being assigned to being cleaned by environmental services, no changes were made to the room cleaning process during the study time frame. Therefore, the change is most likely the result of an improvement in the time to bed assignment after the ED order was placed. This is likely due to a synergistic effect between an admissions order that specified appropriate campuses for bed assignment and a central bed assigner, the patient placement coordinator. While the absolute change in times were not statistically significant at any of the study sites, the results were clinically significant. A reduction in time to inpatient beds being ready of an average of 25 minutes per patient translates to 4,807 patient hours. During the study period, our average admission rate was 24%, and average turnaround times for admissions and discharges were 466 minutes and 225 minutes, respectively. Assuming those metrics, an additional 1013 patients could have been seen in the ED, without any other operational improvements.

Admissions were relatively stable during the study period, with no statistical difference at any of the three study sites. After implementation of the UAO, admissions were more evenly distributed amongst the three clinical sites. Admissions from Site A, which was consistently over capacity preceding the UAO, increased to both clinical affiliates. Admissions from Site B to the other two clinical campuses also increased, but less so. While the admissions from site C decreased to Site B and Site C, this was offset by the intercampus admissions from the other clinical sites. Overall, 391 patients, 3% of all admissions, were admitted to a new campus after implementation of the UAO.

As would be expected, as Site B became more utilized, the ED flow metrics suffered. Both the LWBS rate and boarding rate increased by 2% in the four months following implementation of the UAO. The boarding rate decreased at Site A by 5% and did not worsen at Site C. The reduction in boarding at Site A is likely due to a larger proportion of admissions being directed to Site B from Site A and Site C. Site C is uniquely impacted by external transportation, in that most admissions require inter-facility transport. Thus, the reduction in time from ED admission to bed ready was not the sole determining factor in boarding times for those admissions. Likewise, the LWBS rate did not increase at Site C, but did increase 2% at Site A. This increase is likely influenced by several other variables, including, but not limited to, fluctuating ED volumes and staffing limitations in the ED.

The UAO demonstrates a successful collaboration with hospital administration that led to implementation of a standardized process at the institutional level, which is something previously reported to be necessary for improved operations throughout the health system, and in particular, in the ED.[9] While the focus of this study was on operations, further work should be done to evaluate the impact on patient safety and quality of care.

Limitations

This study is most limited by the inability to control for additional variables that influence the admissions process from the ED to the inpatient setting. These include, but are not limited to, the confounding variables of fluctuating ED volumes, staffing shortages, room and equipment maintenance, and the extraneous variable of differing inpatient length of stay. This study was also conducted at a single, urban, academic center, which limits generalizability.

5. CONCLUSIONS

The UAO more evenly distributed admissions across multiple campuses in a health system. While there were likely other variables at play, there was system-wide reduction in the time to inpatient beds being ready to accept ED patients, and an improvement in boarding at the main clinical site. Our work suggests that a UAO could be a useful adjunct to central capacity management in a health system with multiple clinical

campuses.

ACKNOWLEDGEMENTS

We would like to thank the entire bed planning team and the EHR team for their input and assistance with this project.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

REFERENCES

[1] Bellow AA, Gillespie GL. The Evolution of ED Crowding. Journal of Emergency Nursing. 2014; 40(2): 153-160. PMid: 23481863. https://doi.org/10.1016/j.jen.2013.01.013

[2] American College of Emergency Physicians. Crowding. April 2019. [Retrieved October 17, 2022]. Available from: https://www.acep.org/patient-care/policy-statements/crowding/

[3] Nippak PMD, Isaac WW, Ikeda-Douglas CJ, et al. Is there a relation between emergency department and inpatient lengths of stay? Canadian Journal of Rural Medicine. 2014; 19(1): 12-20.

[4] American College of Emergency Physicians, Emergency Medicine Practice Committee. Emergency Department Crowding: High Impact Solutions. May 2016. [Retrieved October 17, 2022]. Available from: https://www.acep.org/siteassets/sites/acep/media/crowding/empc_crowding-ip_092016.pdf

[5] Boudi Z, Lauque D, Alsabri M, et al. Association between boarding in the emergency department and in-hospital mortality: A systematic review. PLOS ONE. 2020; 15(4): e0231253. PMid: 32294111. https://doi.org/10.1371/journal.pone.0231253

[6] White BA, Biddinger PD, Chang Y, et al. Boarding inpatients in the emergency department increases discharged patient length of stay. The Journal of Emergency Medicine. 2013; 44(1): 230-235. PMid: 22766404. https://doi.org/10.1016/j.jemermed.2012.05.007

[7] Singer AJ, Thode HC, Viccellio P, et al. The association between length of emergency department boarding and mortality. Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine. 2011; 18(12): 1324-1329. PMid: 22168198. https://doi.org/10.1111/j.1553-2712.2011.01236.x

[8] Janke AT, Melnick ER, Venkatesh AK. Hospital Occupancy and Emergency Department Boarding During the COVID-19 Pandemic. JAMA Network Open. 2022; 5(9): e2233964. PMid: 36178691. https://doi.org/10.1001/jamanetworkopen.2022.33964

[9] Kelen GD, Wolfe R, D'Onofrio G, et al. Emergency Department Crowding: The Canary in the Health Care System. NEJM Catalyst Innovations in Care Delivery. 2021. Available from: https://catalyst.nejm.org/doi/full/10.1056/CAT.21.0217

[10] DeLaney M. Emergency department boarding: The canary in the coal mine. Journal of the American College of Emergency Physicians Open. 2021; 2(1): e12290. https://doi.org/10.1002/emp2.12290

[11] Derlet RW, Richards JR. Ten Solutions for Emergency Department Crowding. Western Journal of Emergency Medicine. 2008; 9(1): 24-27.

[12] Haraden C, Resar R. Patient Flow in Hospitals: Understanding and Controlling It Better. Frontiers of Health Services Management. 2004; 20(4): 3-15. PMid: 15219146. https://doi.org/10.1097/01974520-200404000-00002

[13] Johnson M, Capasso V. Improving Patient Flow Through a Better Discharge Process. Journal of Healthcare Management. 2012; 57(2): 89-93. PMid: 22530290. https://doi.org/10.1097/00115514-201203000-00004

[14] Henderson D, Dempsey C, Appleby D. A Case Study of Successful Patient Flow Methods: St. John's Hospital. Frontiers of Health Services Management. 2004; 20(4): 25-30. PMid: 15219148. https://doi.org/10.1097/01974520-200404000-00004

[15] Jweinat J, Damore P, Morris V, et al. The Safe Patient Flow Initiative: A Collaborative Quality Improvement Journey at Yale-New Haven Hospital. The Joint Commission Journal on Quality and Patient Safety. 2013; 39(10): 447-AP9. PMid: 24195198. https://doi.org/10.1016/S1553-7250(13)39058-8

[16] Resar R, Nolan K, Kaczynski D, et al. Using Real-Time Demand Capacity Management to Improve Hospitalwide Patient Flow. The Joint Commission Journal on Quality and Patient Safety. 2011; 37(5): 217-AP3. PMid: 21618898. https://doi.org/10.1016/S1553-7250(11)37029-8

[17] Villa S, Barbieri M, Lega F. Restructuring patient flow logistics around patient care needs: Implications and practicalities from three critical cases. Health Care Management Science. 2009; 12(2): 155-165. PMid: 19469455. https://doi.org/10.1007/s10729-008-9091-6

[18] Barrett L, Ford S, Ward-Smith P. A bed management strategy for overcrowding in the emergency department. Nursing Economics. 2012; 30(2): 82-87.

[19] Lovett PB, Illg ML, Sweeney BE. A Successful Model for a Comprehensive Patient Flow Management Center at an Academic Health System. American Journal of Medical Quality: The Official Journal of the American College of Medical Quality. 2016; 31(3): 246-255. PMid: 25550446. https://doi.org/10.1177/1062860614564618

[20] Healy-Rodriguez MA, Freer C, Pontiggia L, et al. Impact of a Logistics Management Program on Admitted Patient Boarders Within an Emergency Department. Journal of Emergency Nursing. 2014; 40(2): 138-145. PMid: 23380302. https://doi.org/10.1016/j.jen.2012.12.008

[21] Brideau LP. Flow: Why Does It Matter? Frontiers of Health Services Management. 2004; 20(4): 47-50. PMid: 15219151. https://doi.org/10.1097/01974520-200404000-00008