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Boarding in the Emergency Department

Abstract

The purpose of this research was to identify the causes of boarding in the emergency department (ED), look into the resulting effects in which an overcrowded ED may create, and lastly, delve into potential interventions and solutions to counter the factors which create the issue of boarding. Boarding in an ED is a trending topic an dis relevant to healthcare and can be a factor in life or death. research methods included a in-depth literature review of nursing journals, medical journals, systematic reviews, and cross-sectional studies found via CINAHL and PubMed. Results showed that periods of boarding and a longer length of stay resulted in higher mortality and adverse patient outcomes. Interventions mentioned included more efficient coordination of care, higher staff to patient ratios, and quicker test results and transport times.

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Boarding in the Emergency Department

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One of the most current trending topics in healthcare today is the international crisis of emergency department (ED) boarding and crowding of patients. The emergency department is a unique element of the hospital. Unlike doctor's offices or other community health care services, the emergency department is always available to the public and can be utilized twenty four hours a day, seven days a week. This uniqueness of the emergency department can solve problems that are specific to the unit and effect patient care and safety from the very beginning. In 1986, the Emergency Medical Treatment and Labor Act mandated that all patients who present to an ED in the United States must receive a medical screening examination, regardless of their ability to pay or if they have health insurance (Fogarty, 2014). This is why, so often we hear the term "safety net" used synonymously with the emergency department because anyone from anywhere can receive help from the ED. However, the increasing demand on the ED is straining this safety net to a breaking point, leading to serious medical issues, patient dissatisfaction, and other complications (White and Biddinger, 2012). ED boarding and crowding manifests from a variety of causes and results in complications and problems that can potentially be solved or combatted with interventions and solutions implemented by hospital leadership.

Emergency Department boarding is the practice of holding patients in the ED or another temporary location after the decision to admit or transfer has been made (Fogarty and Saunders, 2014, p. 709). In addition, boarding inpatients in the ED is a significant contributor to crowding and the resulting adverse outcomes (White and Biddinger, 2012). Boarding and overcrowding is a relevant topic and many healthcare professionals, management, and administration want to get to the root of the causes of these conditions. A major cause of ED crowding is the amount of inpatient beds needed to house patients. Sometimes the supply of these beds does not meet the demand and the hospital reaches full capacity. This leads to a trickle-down effect when there are

no inpatient beds available for ED patients. The ED patients get stuck down in their ED beds waiting to go up to the unit, even though the order to convert their status from an emergency room patient to an inpatient was already initiated. Since inpatient status patients are waiting in the ED beds, this means the ED will also quickly become full and the patients coming in the front door or by ambulance have no ED beds to go to, which increases the waiting times, length of stay, and patient dissatisfaction. This leads to the charge nurse or hospital administrator making the decision on where to put the patients, sometimes in the hallways, illustrating how boarding directly leads to overcrowding.

Other causes of boarding in the ED include patients who are seen in the emergency department for low acuity conditions which could be taken care of at their primary care physician or urgent care. These tend to be patients with a lack of health insurance, no primary care physician (PCP), or patients with a lack of health literacy. As mentioned earlier, the ED is referred to as a safety net because, by law, it must see any patient with or without health insurance. The Emergency Medical Treatment and Active Labor Act was created to form a type of safety net and to prevent patients who did not have insurance from feeling that they were being treated differently because of their lack of insurance (White and Biddinger, 2012). Patients without insurance often do not have a primary care physician and use the ED as their “doctor’s office” because they have no other way of obtaining healthcare. Also, some medical situations occur during the weekend when the patients’ doctor’s offices are closed. It is the same situation with nursing home patients whose doctors are not available on the weekend. In regards to patients who may not know much about health care, they may come in for low acuity situations or a condition that is natural or a simple side effect of a new medication that does not require medical treatment. These patients still must be screened in the ED and take up a bed,

resources, and staff. Patient acuity and triage is utilized in the ED to determine the sickest patients who need ED beds the most. Patient acuity is determined by an experienced nurse in triage and they are often the first healthcare worker to come in contact with the patient. They assess a patient's condition using subjective and objective data, patient history, and current findings in the form of vital signs and possibly an ECG to determine which level of acuity the patient fits into (Fogarty and Saunders, 2014). If the ED is full, the patient will often go back to the waiting room unless the patient is in extreme conditions or experiencing a life-threatening situation. Often patients become dissatisfied because they believe the ED to be a first-come-first-served system, but the triage nurse will take a patient with a more life-threatening, or emergent, condition before someone who will remain stable if they have to wait. This is where data becomes skewed because some organizations who track patient length of stay use the point of registration, or patient presentation, as a means of ED length of stay. ED length of stay is used as a metric of ED efficiency and throughput (Hoot, 2008, p. 124). A patient who is registered and then sits in the waiting room for hours before getting an ED bed will have a long length of stay even though only 25% of their visit was being medically treated versus their 75% waiting time. A recent cohort study shows that the overall length of stay of patients discharged from the ED increased by approximately 10% as the boarding burden increased (White and Biddinger, 2012).

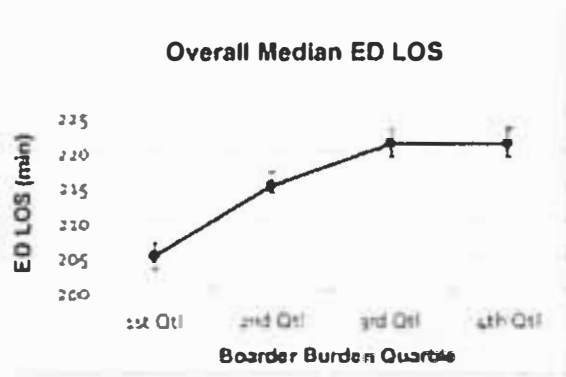


Figure 1. Overall median ED length of stay stratified by boarder burden quartile.

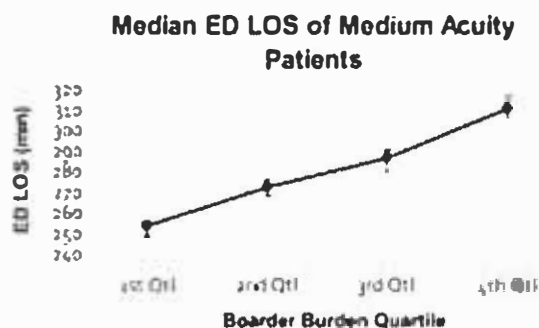


Figure 2. Median ED length of stay of medium-acuity patients stratified by boarder burden quartile.

The overall data of these findings is significant because it shows the increase in length of stay positively correlates during a period of boarding in the ED.

After reviewing a systematic review of emergency department crowding, author, Hoot, chose to look at the input, throughput, output model of a patient’s journey in the ED (2008). Hoot looked at input factors which could lead to ED boarding and crowding and found that non-urgent visits in the form of “frequent-flyers” and the influenza season to be common factors. Although mentioned before that low acuity visits and lack of access to timely primary care doctors was a contributing factor, Hoot found that frequent visitors, which is defined as four or more annual visits to the ED, accounted for 14% of total ED visits. A similar report found that

500 of the most frequent users of one ED accounted for 8% of total visits, and 29% of these visits were deemed appropriate for primary care (Hoot, 2008, p. 135). These statistics indicate that there is an abuse of the ED because less sick patients are taking ED beds from those who have worse conditions. During flu season there was a significant increase in boarding. In a hospital in Toronto, every 10 local cases of the flu resulted in a 1.5% increase in the fraction of ED visitors who were elderly flu patients. This also resulted in an increase of 2.5 hours per week of ambulance diversion which is a status in which an ED does not accept EMS patients, but instead refers to another ED (Nakajima, 2015). Hospitals receive calls giving a minor report to the hospital of the patient and their condition. Usually ambulances bring patients to the closest ED but ambulance diversion is when a hospital intentionally tells the ambulances to go elsewhere because the hospital is at full capacity and the patient is stable enough to take the extra travel time to another hospital rather than waiting longer at the closer hospital. Recently discharged patients accounted for just 3% of total visits to one ED, but they had longer lengths of stay and more frequent hospital admissions than other patients. This means that one could potentially rule out the cause of boarding as healthcare personnel who misdiagnose or provide sub therapeutic treatment for the patient causing them to return as a major contributing factor.

After looking at the many ways patients present themselves to the ED (input), throughput factors are the next step in the patient flow process. The most common factor, hands down, was inadequate staffing (Fogarty, 2014). Studies show that the average nurse was caring for four to five patients simultaneously and the average physician was caring for 10 patients simultaneously (Hoot, 2008, p. 129). Although this is the average nationally, imagine having extra staffing and resources to quickly and efficiently take care of patients. Wait time would decrease, simple tasks and skills would get done quicker, and medications could be effectively prescribed, distributed,

and education provided more quickly. Lastly is output, or the different transitions a patient can undergo whether he or she is being discharged home or transferred to another unit (inpatient). An obvious contributor to boarding is insufficient beds. Not enough inpatient beds will always be a factor but the question is whether or not a patient needs to stay inpatient or if they could go to an observation bed, or possibly home earlier.

There are many causes of boarding and factors that lead to ED crowding that affect the journey of the patient in the form of input, throughput, and output. Boarding and crowding in the ED is a growing issue in healthcare and many are trying to figure out interventions that can help prevent this issue from expanding.

There are many factors that cause and contribute to the national issue of boarding in the ED which results in adverse events. These negative effects can range from patient dissatisfaction to an increase in mortality and morbidity regarding patient outcomes. A specific study looks at the issue of boarding and crowding in the ED as a result of insufficient inpatient capacity and the difficulty transferring patients from the ED to inpatient units. Items looked at included quality of care, delays in medication administration, and delays in laboratory tests (Chang, 2014, p. 1033). The authors obtained IRB approval and performed a secondary analysis of observational data from medical record review and administrative databases at two level 1 trauma facilities. They looked at patients who were admitted for over 26 hours with specific conditions of pneumonia, chest pain, or cellulitis. They chose these conditions because: “they are common reasons for admission, have guidelines for their care, and require follow-up laboratory tests and/or medications (Chang, 2014, p. 1034).” Per facility policy, the time on the inpatient unit starts two hours after leaving the ED allowing for a two hour transition between the ED and the floor-to-target time. The determination of definitions for “delays” and “reasonable time frame” were set

by three board-certified emergency physicians. Delayed was defined as being greater than two hours after the standard institutional interval between laboratory tests. (Delayed cardiac enzyme was defined as a laboratory check greater than 10 hours after the previous test. A delayed PTT was defined as a laboratory check greater than 8 hours after initiation of heparin). The results showed that medication-related events were higher specifically in relation to antibiotics, versus laboratory-related events such as cardiac enzyme rates or PTT checks (Chang, 2014, p. 1035).

The following table illustrates the results of the authors' study:

Event rates (events per 100 pt-hours) while boarding in the ED vs while on an inpatient unit

Table 2.

Event rates (events per 100 pt-hours) while boarding in the ED vs while on an inpatient unit

Delays and adverse events	ED boarding	Inpatient unit	P	Risk ratio (95% CI)
n	Event rate	n	Event rate	
Delayed home meds	110	8.35 (121/1449)	685	5.42 (421/7763) < .001 1.54 (1.26-1.88)
Delayed antibiotic	59	7.78 (39/501)	355	3.15 (137/4352) < .001 2.49 (1.72-3.52)
Delayed cardiac enzyme	150	1.16 (15/1296)	556	6.92 (153/2210) < .001 0.17 (0.09-0.27)
Delayed PTT	30	4.45 (11/247)	194	8.36 (87/1041) < .001 0.54 (0.27-0.96)
Adverse events	425	0.16 (14/8536)	404	0.07 (18/25 848) 0.02 2.36 (1.15-4.72)

n = number of patients eligible to have a delay or adverse event (eg, patients may not have a home medication or cardiac enzyme due while boarding. Conversely, patients may be eligible for multiple events during boarding or on the inpatient unit).

The study found that medication delays and adverse events were higher while boarding in the ED compared to on an inpatient unit; however, laboratory delays were lower while ED boarding was taking place (Chang, 2014, p. 1035). The authors offer explanations as to why boarding might

be related to adverse events, especially medication delays, since their study indicated that medication delays were the most significant negative outcome. One explanation is that emergency physicians and clinical staff may view the patient as already having been evaluated with treatment plans in place. The mindset that most, or all, of the work has been done causes them to focus their attention on the new ED patients they are getting. Also, emergency physicians (EP) have different skill sets than inpatient providers (Chang, 2014, p. 1036). EPs are not trained to manage chronic conditions, like inpatient providers, which could explain the delay of home medication administration that patients have been taking for a while. Another issue is that sometimes patients, or their families, do not have medication lists available right away or they cannot remember the specific medications they were prescribed. Therefore, clinical staff must take the time to call nursing homes or outpatient pharmacies which can be time consuming. Overall, this study highlighted the outcomes of boarding in the ED. Results showed that more medication-related delays and adverse events occurred during periods of boarding, but not laboratory tests. This confirms that the ED is designed to rapidly obtain diagnostic results and deliver acute care.

Another serious effect of boarding and crowding is the association with mortality. This includes patients who are admitted and those of whom are discharged. Clinical lead and consultant in Emergency Medicine, Henderson, discusses a study that found a 34% higher ten day mortality rate for admitted patients who had been taken care of during a period of crowding as compared with those managed during a non-crowded period (2014, p. 23). Over-crowded shifts were defined as those shifts in the highest quartile of mean occupancy for three 48-week periods. Researchers found that presenting during shifts with longer waiting times was associated with a greater risk of short-term death and admission to the hospital. This study

looked at a 7-day outcome over the span of four years. All of the patients met criteria for being discharged by the emergency medical teams that oversaw them. Issues regarding quality of care also emerge during busy times. Henderson references a study which showed that for every hour spent in the emergency department the odds of experiencing an adverse event in the hospital increased by 3%. Experiencing an adverse event, in turn, doubled length of stay in the hospital. Studies have shown that patient care deteriorates in a crowded ED due to the stressful environment, too much work to worker ratio, and limited resources in the hospital (i.e. X-ray, Ultrasound machines). This article also references the delay in time-sensitive interventions in patients with pneumonia, chest pain, and septic patients similar to the article by author, Chang.

Henderson talks about the compromise of quality of care regarding a crowded ED. She references studies that indicate the stress and workload of a crowded environment can indirectly affect the ability of clinicians and medical staff to make the most appropriate decisions for their patients. One study found that more patients are triaged to a lower acuity category during crowded shifts vs. non-crowded shifts. Although this is not statistically significant, the lower acuity group showed an increase in mortality when compared to the group triaged to a higher triage category (Henderson, 2014, p. 28). These results indicate that patients with a higher triage category are treated with a higher urgency and receive more astute care.

Another negative outcome is patient *and* staff dissatisfaction. Not surprisingly, patient satisfaction scores decrease during times of boarding and crowding. Long wait times, poor access to restrooms, and limited privacy are all factors that decrease satisfaction scores and cause an increase in complaints. Sometimes patients are triaged when they first come in but end up waiting for hours. They end up leaving before being seen by a physician and leave without treatment. Studies show these patients to be younger and have lower acuity scores, however this

does not justify patient dissatisfaction.

Not only does patient dissatisfaction increase but also the dissatisfaction of healthcare workers. Studies show that times of overcrowding and boarding affect nurses the heaviest. Surveys of emergency nurses found that 82% had moderate to high burnout rates and that 86% had moderate to high compassion fatigue (Henderson, 2014, p. 17). These factors go back to patient satisfaction and how it is compromised in this type of environment. The author highlights the adverse effects of patient dissatisfaction and decreased staff morale which are decreases in quality of care, and increases in mortality by referencing multiple studies. The information she includes supports and reinforces the existing evidence and literature which already exists.

The reason hospital administration, physicians, nurses, and multidisciplinary and ancillary roles work to identify causes of boarding and crowding in the ED and minimize negative outcomes of these causes is to comply with the standards enforced by the Joint Commission along with funding from the government based on these standards. In 2012, The Joint Commission released revisions for what is known as the “patient flow standard”. The organization set a four hour time frame as acceptable for boarding. They based this decision on a literature review and an in-person public field review. The Joint Commission found such a huge gap between the literature and best practice so they did a public field review from December 2011 to January 2012 from 788 total responding hospitals of which 75% were accredited. (Joint Commission on Accreditation of Healthcare Organizations, 2012). A large majority agreed that a time frame for boarding should be established. A follow-up question of what this time frame should be was given, the most frequent response was four hours. However, there was a disparity between medical-surgical patients versus behavioral patients. The most reported time was four

hours but a notable percentage provided answers of 24 hours to 72 hours for the psychiatric or substance using patients. The decision to use the four hour time frame was made but the Joint Commission realizes that boarding time frames will be different from one facility to the other based on factors of size, demographics, season, and patient type. They use the four hour time frame for boarding as a goal but not a factor for accreditation (Joint Commission on Accreditation of Healthcare Organizations, 2012).

The Joint Commission also wanted to address patient flow through the Emergency Department. The organization released this statement, “The standards revisions recognize that, although patient flow problems often manifest in the ED, their origins may be multifactorial and stem from other areas in the hospital (Joint Commission on Accreditation of Healthcare Organizations, 2013).” This statement motivates ED workers to continue their work because it reassures them it is a systemic problem. It also encourages the other units in the hospital to ask themselves if there is something they can do to be a part of a solution to reduce the complications of boarding even though the stigma is placed on those working in the Emergency Department. The Joint Commission encourages hospital leaders to look at specific factors that might be attributing to the cause of boarding. These metrics include to anticipate seasonal trends or annual trends which affect business, monitor and manage patient flow through the whole journey of the patient throughout the hospital, and create a common vision with goals which are clear and direct (Joint Commission on Accreditation of Healthcare Organizations, 2013). Seasonal trends could be that the surrounding community annually gets a respiratory virus in the winter along with asthma exacerbations so staffing might be increased in the winter months. Looking at the patient’s entire journey throughout a hospital can help identify lags in care or various obstacles the patient might experience from one department to the next. For example, a patient might be in

the ED but need to go off unit to get an endoscopy, MRI, CT scan, or x-ray. If these departments do not schedule patients efficiently, then multiple patients might be sent to these departments at once and are forced to wait their turn before returning back to the ED. A shared goal and vision will help staff to all be on the same page. Some hospitals have policies in place on the amount of time it should take for a patient to get to the cath-lab regarding a chest pain patient or the amount of time a patient with a burn should be taken to the burn unit. Keeping these goals in mind will help staff prioritize the patients and the care they need in order to fulfill these goals. The Joint Commission holds the hospital administration leaders responsible to set their own goals for patient flow. They recommend that the hospital leaders should focus on safety areas for where patients receive their treatment and services, access to case management and social work, available supply of beds, and staff. These flow processes and metrics must be monitored and assessed for success to see if the goals are being achieved. If these goals are not achieved then leaders must take some form of action and include multiple members of the medical team. These members include, but are not limited to, the chief executive officer, senior managers, the nurse executive, clinical leaders, and staff members in leadership positions within the organization (Joint Commission on Accreditation of Healthcare Organizations, 2013).

Regarding psychiatric patients or substance-using patients, the flow can sometimes be slower than a regular medical patient. Most emergency facilities have a psychiatric/mental health section in their ED which usually faces boarding problems as well. Reasoning is that mental health patients with suicidal or homicidal thoughts must be stabilized before placement in a specialized psychiatric service or outpatient facility. Also, substance abuse patients must also be medically cleared before beginning psychiatric treatment. These factors can cause this type of patient to stay in the ED much longer than a regular medical patient. The Joint Commission

addresses on-going deficiencies seen across the country regarding a safe physical environment, staffing, assessment and reassessment for these patients which can change from stable pretty quickly. The Joint Commission revised a provision stating that, “if a patient is boarded while awaiting care for emotional illness and/or the effects of alcoholism or substance abuse, the hospital must” secure a location clear of potentially harmful items that is safe and monitored, provide training for any clinical and/or nonclinical staff that might be taking part in safe care, and conduct assessment and reassessments that reflect the patient’s needs (Joint Commission on Accreditation of Healthcare Organizations, 2013). Most emergency rooms have a psychiatric section in which rooms are designed with monitors and cleared of any potential equipment that the patient could use to harm his/herself or someone else, but if this section is full or there is not this type of section in one’s facility, the facility must take a regular room and change it to fulfill the set of criteria the Joint Commission set standards. Training or education on how to interact therapeutically with psychiatric/substance-using patients for clinical and non-clinical staff is vital. Sometimes clinical staff might not typically work with these types of patients but there are many instances in which they might have to. One must know about psychiatric medications, therapeutic communication, and how to de-escalate a progressive situation that could develop into something violent. This is very important for non-clinical staff as well who might be volunteering in that unit or patient sitters. Having to assess and reassess as appropriate for the patient seems vague but this standard just reminds staff to check on this type of patient as per hospital policy because it is not enough to lay eyes on the patient once and leave them on the side because the patient will be staying in the room for hours. Assessment and vital signs must be done with a logical frequency in order to deliver safe care for all patients.

Mentioned earlier, one major factor of ED crowding is the lack of access to inpatient

beds. A U.S. Government Accountability Office (GAO) report affirmed this in 2009 (Pitts, 2014). This report stimulated multiple studies ranging from empirical, geographical, interviews, surveys, and field studies regarding the subject of boarding. Before this GAO report, there was a study in 2008 which indirectly gathered data from ED surveys which they inferred boarding times from these surveys. The GAO report recognized that simple visit-level measures regarding boarding were being collected by a branch of the Centers for Disease Control and Prevention known as the National Center for Health Statistics (NCHS). However, this simply was not enough to gather from in order to hold a substantial study and gather reliable and efficient data. This GAO report triggered the meeting of “key stakeholders” organized by the National Quality Forum, the Centers for Medicare and Medicaid Services, and the Joint Commission which are all powerhouse organizations. This helped establish the very real issue of ED boarding that has been affecting the United States long before 2009. The GAO report paved the way for future studies and metrics that would later be used as pieces for accreditation and quality improvement utilized by hospitals and facilities all over the nation. The authors’ goal was to evaluate the magnitude of ED boarding by analyzing the first national survey of boarding items in the National Hospital Ambulatory Medical Care Survey (NHAMCS) which is the only national probability survey of ED visits (Pitts, 2014). Methods used was a cross-sectional analysis of a national sample of ED visits. It was approved by the NCHS Research Ethics Review Board annually since 2003. The NHAMCS pulls roughly 35,000 to 40,000 patient record forms from 350 to 400 EDs from across the country each year. In 2007, a survey asked ED administrators annually if they ever boarded patients for more than two hours and whether they used the “full-capacity protocol” which is the strategy of moving admitted patients to hallways or other parts of the hospital until the bed was available (Pitts 2014). In 2009 and 2010, the survey added the

patient visit-level metric “length of time waiting for hospital admission (minutes) calculated from date and time of bed request for hospital admissions and date and time patient actually left the emergency department.” This additional item is used to define a boarding time. The authors used Stata version 12 for analysis of their data. They used one of two probability weights supplied by NCHS for ED-level analysis and for visit-level analysis. One limitation their data had was the high nonresponse rate for boarding times regarding the ages of 15 to 45 years old, Hispanic ethnicity, and uninsured payer types. The results of their study included 341 different emergency departments that were included in the sample annually. A total of 9,117 patient record forms containing the boarding time item were used. Analysis showed 61% of EDs reported that they sometimes boarded patients for more than two hours, but only 19% used the “full capacity protocol” during periods of severe crowding (Pitts, 2014, p. 498). An interesting fact is that the emergency departments that reported times of boarding their patients saw far more visits, three times as much, as emergency departments that reported minimal boarding. This finding can indicate that boarding directly relates and positively correlates with ED census and amount of beds available, or capacity. The authors also looked at similar characteristics regarding the population of boarded patients and these included those of older age, arrival by EMS, arrival during office hours, and advanced imaging such as ultrasound, computed tomography, and magnetic resonance imaging. The authors also found that longer boarding duration was not associated with gender, race/ethnicity, payer type, triage category, or intensive care unit (ICU) admissions (Pitts, 2014, p. 499). The EDs associated with the longest boarding times were geographically located in the northeast region of urban areas and consisted of non-Hispanic black ethnicity and race. Relating back to a previous factor of boarding is a gap in health literacy in urban communities. A future factor that might be assessed could be highest

education level to acknowledge the statistic that urban areas have longer boarding times, possibly due to non-urgent visits being trumped by higher acuity patients, forcing those presenting at the ED for low acuity visits to wait longer. Supporting the findings of previous studies, this cross-sectional study affirms the relationship between ED volume and boarding. Findings report that boarding is an issue throughout the country, specifically in urban areas and in the northeast region. One highlighted finding is that both ED volume and ED occupancy does not increase continuously but reaches a problem when ED volume and occupancy reaches a “threshold value” at a certain point (Pitts, 2014, p. 499). This implies that rather than being a response to the characteristics of ED patients, boarding is a system response to a high patient load. This finding relates to the statement that the Joint Commission released mentioned earlier that boarding is not only an ED problem but a problem that an entire hospital is a part of. The following table illustrates the length of stay, ED volume, and ED occupancy.

Table 3. ED Operational Metrics, Summarized by Quartile of Boarding Time, United States, 2010

Metric	Quartile of Median Boarding Time				All EDs
	First	Second	Third	Fourth	
1. a	The NHAMCS oversamples larger EDs. Unequal weights prevented the formation of exactly equal-sized quartiles of boarding. NHAMCS = National Hospital Ambulatory Medical Care Survey.				
2. b	Defined as triage category 1 or 2 in a five-level classification system. Details in NHAMCS on-line documentation.				
3. c					

Metric	Quartile of Median Boarding Time				All EDs
	First	Second	Third	Fourth	
Defined as the weighted sum of lengths of visit in minutes in 2010, divided by the number of minutes in a year.[2]					
Median boarding time (minutes), range	0-24	25-45	46-86	87-410	0-410
Number of EDs sampled	49	50	110	141	350
Number of EDs, weighted estimate ^a	1,053	989	1,335	1,345	4,722
Measures related to input					
Total number of ED visits (millions)	16.8	18.2	41.3	53.6	129.8
Mean annual visits per ED (visits/EDs, in thousands)	16.0	18.4	30.9	39.9	27.5
Percent high acuity visits ^b	10.8%	11.8%	10.3%	13.8%	12.0%

Metric	Quartile of Median Boarding Time				All EDs
	First	Second	Third	Fourth	
Measures related to throughput					
Median wait to be seen (minutes)	21	24	30	31	28
90th percentile wait to be seen (minutes)	99	96	113	133	118
Mean ED occupancy (persons present per ED):	5.1	5.8	11.3	16.6	10.3
Measures related to output					
Hospital admissions (millions)	1.7	2.0	5.5	8.1	17.2
Admission rate (admissions/visits)	10.1%	10.8%	13.2%	15.1%	13.2%
Median length of hospital stay (days)	3	3	4	4	4

Mentioned before, the Joint Commission set a four hour threshold to define a boarding time based on the majority of those who responded. Its substitution for a two hour threshold is used now and has had a substantial effect on boarding and length of stay. Nationally, boarding rates have dropped from 32% to 10% (Pitts, 2014, p. 501). Using the four hour mission correlated with less productive occupancy of ED treatment spaces, decreased efficiency, and longer patient waits. The authors of this article concluded that boarding of inpatients in emergency departments is a national issue, especially in hospitals with higher volumes. Future reimbursement or accreditation sanctions may cause for higher response rates and lower boarding rates based on an incentive for hospitals to meet possible future sanctions.

Already discussed were some causes of boarding and the adverse effects that associate with those causes, but there are also some solutions or interventions that could potentially counter ED boarding. Multiple authors talked about causes of boarding in the ED could be limited patient beds, seasonal conditions such as the flu, and insufficient staffing. Authors also discussed how adverse effects could include patient and staff dissatisfaction, patient mortality or worsening conditions, and failure to meet the Joint Commission's standards. One intervention that has been used in the past is ambulance diversion in periods of high census. Ambulance diversion, also known as bypass or closure, is a status in which an ED takes on when their facility is full with a long waiting room time. The facility receives the call request from the EMS and will not take the patient but refer to a different facility (Nakajima, 2015). Ambulance diversion was first used as a way to reduce crowding in the ED in New York City in 1990. Over the years, questions of the practicality, financial, and moral implications have been raised. Morally ambulance diversion does not benefit the patient because he or she would have to wait in the ambulance longer and there is no guarantee that the accepting facility does not have a wait

itself. One facility in San Diego established a rule that diversion could only last an hour at a time; this was shown to be very effective in reducing time spent on diversion (Geiderman, 2014). Some studies showed that ambulance diversion does not benefit the facility in regards to alleviating crowding so the state of Massachusetts eliminated diversion completely in 2009. Follow-up studies indicated improved quality of care, increased annual revenue, and better relationships with EMS staff. There are still articles arguing that ambulance diversion does benefit emergency departments in the reduction of crowding. These articles discuss boarding and crowding in the ED and talk of the many patients seen in the hallways which are utilized as “patient rooms”. A newer term being used is “wall time” or the time it takes to move a patient from the ambulance gurney to a hospital bed (Geiderman, 2015). Times of up to two hours have been reported because EMS workers must wait for a room assignment or placement and have the nurse or worker taking on the patient sign as a formal acceptance of the patient. In times of boarding and crowding this could definitely take longer than one would think. Overall, ambulance diversion definitely does not solve the issue of ED boarding by itself. It is a quick intervention to relieve temporary crowding, but is not shown to benefit the healthcare facility overall.

Another intervention that has been looked at in order to reduce overcrowding in the emergency department is point-of-care testing (POCT). The idea behind this type of testing in the ED is to reduce length of stay, increase patient throughput, and increase timely discharge rates (Rooney, 2014). Rooney writes that, “point-of-care testing refers to any diagnostic test administered outside the central laboratory. (2014, pp. 2). The advantages of this type of testing is that these devices are portable and quicker. Caregivers are able to perform, analyze, and obtain then act on test results at the bedside in just minutes versus sending the collected samples

to a central laboratory. A study showed that POCT test results were available on average 46 minutes earlier than from the central laboratory. Below is a table outlining the various examples of tests and how their result time compares POCT vs. central laboratory:

Table 1

Sensitivity and specificity of selected point-of-care analysis compared with core-laboratory analysis

Marker	Sensitivity, %		Specificity, %	
	POCT	Core laboratory	POCT	Core laboratory
CKMB + cTnT				
Single draw	30	30	91	92
Serial draw	43	43	88	91
hCG (urine)	95.3	100	100	100
hCG (blood)	95.8	100	100	100
D-dimer	83.3	100	100	100
	100	100	73.3	67.9

CKMB, creatine kinase-MB; cTnT, cardiac troponin T; hCG, human chorionic gonadotropin;

POCT, point-of-care testing.

Based on the data above, there is evidence of a decrease in turnaround times (TATs) for test results with POCT in an emergency setting (Rooney, 2014). Although these test results come back quicker, facilities must look at other factors. Some challenges would be having to alter or change ED pathways of care. Also training ED nurses who would be the main staff

administering these tests. This could meet resistance because of the large work load nurses already are responsible for and a previous contributing factor to the causes of boarding was a shortage of staff. Another factor is that POCT tests do cost more than sending samples to a central lab, but the benefit of the turnaround times in the ED could possibly counter this cost. Another factor is that POCT seemed to be more beneficial in rural areas versus urban areas. POCT devices have a huge potential of reducing wait times in the ED if used appropriately and implemented in an effective way. POCT has been shown to decrease delays in treatment initiation, improve outcomes, increase timely discharge rates, and decrease the overall length of stay.

Another potential solution towards the issue of boarding in the emergency department is more efficient bed management in order to counter the lack of inpatient capacity as a cause to boarding and crowding in the ED. A level 1 trauma facility in Rhode Island conducted two pilot studies consisting of a baseline control period and a subsequent study period. The hospital looked at problems in proper bed and unit placement for admitted patients which is normally guided by specific hospital protocols. The article provides an example of a dialysis patient with pneumonia who would be appropriately admitted to a renal floor versus respiratory floor due to the special training in dialysis (Rathlev, 2014). Improper bed and unit placements resulting from not following protocols can cause a waste of resources, time, and efficiency. The process of assigning admitted patients to a specific floor and bed is complicated and ever-changing. Emergency physicians and admitting providers were found to be insufficiently trained or unaware of specific protocols to follow when making the decision to hospitalize. The Rhode Island Hospital decided to implement a patient placement manager (PPM) who is a clinically experienced registered nurse which has specialized training in institution criteria for correct unit

and bed placement based on an admission diagnosis and the acuity of the patient. The PPMs have to discern between observation vs. inpatient status as well as critical care vs. intermediate care. The methods of the Rhode Island Hospital study consisted of two pilot studies that included every patient who was admitted. The first pilot was intended for training and to explore if the second pilot was feasible. Both pilot studies started with a control study followed by another study for comparison. The process included an ED attending physician who would decide if a patient was being admitted and then page the admitting physician. The patient's presentation, admitting diagnosis, and assignment of bed status was discussed. Separately, the PPM would receive this information electronically and find a patient the right bed. During the study period, a direct three-way phone call between the PPM, emergency physician, and the admitting physician in order to come to a consensus of the most appropriate placement of the admitted patient. The author hypothesized that this process would improve patient care by placing them in the right bed the first time and avoid "lateral transfers" after the patient arrived on the initial floor. A "lateral transfer" is an improper assignment resulting in the transfer of a patient to a different floor within six hours of arrival on an inpatient unit (Rathlev, 2014). An example the author provided was a patient requiring telemetry monitoring but goes to a floor which does not provide that. The results of the second pilot in contrast to the first pilot were significant in that there was a decrease in lateral transfers by 65% and that the length of stay was also decreased by an average of 49 minutes.

In addition, comments regarding Rathlev's study included the major issue of communication regarding admission and bed/floor assignment. In most cases the ED physician and case manager work closely together to identify the proper placement of the patient based on insurance and medical condition. In larger facilities this could pose a potential problem since

there would be more patients to cover, and the need for clinically experienced medical staff to properly identify the needs of the patient and which floor is most appropriate for them are important. Rathlev recommends a process of bed management which is coordinated by clinically experienced nurses in order to decrease the number of avoidable hospital days, increased net revenue, and decreased denials of payment by insurance companies (2014).

In this day and age, many of the population are living longer. The baby boomer generation is prevalent and the ability of travelling has brought people in and out of the country. The use of the emergency department is increasing in demand, and issues of crowding are found in almost every ED at one time or another. Studies found that the elderly population have longer hospital stays with greater risks for complications and a higher readmission rate. Potential interventions for the elderly care include prevention of readmission by initiating fall prevention teams made up of physiotherapists, occupational therapists, and specialist nurses that address discharge care (Mason, 2014).

A newer possible solution to overcrowding in the ED is telehealth. Telehealth is the communication using technology via webcam to create an online doctor's visit. Physicians are able to view the patient, talk to the patient, obtain a health history and focused physical. This could be useful for those in rural areas who do not have direct access to healthcare, patients who are housebound due to lack of transportation or ability to get to a physician, and it utilizes the online physician as a resource of whether or not the patient's condition is appropriate for an emergency department, urgent care, or doctor's office. This also allows the patient to skip the wait time and not be exposed to the other diseases and germs found in the ED.

Overcrowding and boarding in the emergency department is a hot topic and the medical community is constantly looking at data and literature to identify possible solutions to the many

causes and effects of the accumulating patients that are visiting emergency departments over the world. The issue of health literacy, flu season, and lack of insurance are major causes.

Mortality, worsening conditions, and adverse events are common effects that result from boarding patients. Some interventions are efficient bed management and assigning patients to the correct areas, the utilization of technology to screen patients, and an onsite laboratory to process specimens. Hopefully by identifying the causes of boarding, discussing the negative effects, and looking into potential solutions and interventions to combat said causes and effects will help create a safer and more efficient medical environment in relevancy to the “safety net” known as the emergency department.

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