HHS Public Access

Author manuscript

Ann Emerg Med. Author manuscript; available in PMC 2019 April 01.

Published in final edited form as:

Ann Emerg Med. 2018 April ; 71(4): 497–505.e4. doi:10.1016/j.annemergmed.2017.07.022.

Hospital strategies for reducing emergency department crowding: a mixed-methods study

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Abstract

Study Objective—Emergency Department (ED) crowding and patient boarding are associated with increased mortality and decreased patient satisfaction. This study uses a positive deviance methodology to identify strategies among high, low, and high improving hospitals to reduce ED crowding.

Methods—In this mixed methods comparative case study, we purposively selected and recruited hospitals that were within the top and bottom 5% of Centers for Medicare and Medicaid Services case-mix-adjusted ED length of stay and boarding times for admitted patients for 2012. We also recruited hospitals that showed the highest performance improvement in metrics between 2012 and 2013. Interviews were conducted with 60 key leaders (physicians, nurses, quality improvement specialists, and administrators).

Results—We engaged 4 high performing, 4 low performing, and 4 high improving hospitals, matched on hospital characteristics including geographic designation (urban vs. rural), region,

Conflicts of Interest:
Eric Howell receives salary support from the Society of Hospital Medicine in his role as QI officer

hospital occupancy, and ED volume. Across all hospitals, ED crowding was recognized as a hospital-wide issue. The strategies for addressing ED crowding varied widely. No specific interventions were associated with performance in length of stay metrics. The presence of four organizational domains were associated with hospital performance: executive leadership involvement; hospital-wide coordinated strategies; data driven management; and performance accountability.

Conclusion—There are organizational characteristics associated with ED decreased length of stay. Specific interventions targeted to reduce ED crowding were more likely to be successfully executed at hospitals with these characteristics. These organizational domains represent identifiable and actionable changes that other hospitals may incorporate to build awareness of ED crowding.

Introduction

Background and Importance

The Institute of Medicine and the American College of Emergency Physicians have identified emergency department (ED) crowding as a critical threat to public health.[1,2] Exposure to dangerously crowded ED conditions is associated with increased short-term mortality, delays in care, and worse patient experience.[3,4] With over 130 million annual ED visits[5] and increasing demand for ED services, the negative impacts of ED crowding on public health will continue to intensify.[1] However, effective strategies to reduce ED crowding remain ill-defined despite a decade of operations research.[3,7–11]

First, there have been no systematic efforts to study hospitals with different levels of performance, and the majority of prior studies have evaluated single interventions at single sites.[12–14] Second, we have a limited understanding of the influence that critical organizational characteristics play on ED performance because these variables are difficult to measure and are rarely studied.[15] Third, most studies have focused on processes within the ED, but fail to examine root causes of ED crowding, such as the lack of inpatient beds,[16] which may be outside of ED control. Without an understanding of effective strategies, hospitals may invest in high-intensity yet ineffective attempts to reduce ED crowding.[17–19]

Goals of this Investigation

We sought to identify effective organizational practices to reduce ED crowding using a "positive deviance" approach.[20] We used quantitative data to define a sample of high and low performing hospitals on measures of ED crowding. We then applied qualitative methods – semi-structured interviews with hospital leaders and staff – to elucidate the complex organizational factors (e.g. work processes, social interactions, organizational culture, norms) that distinguish high and low performing hospitals. We analyzed interviews from a separate group of high improver hospitals to validate these findings.

Methods

Study Design and Selection of Participants

In this mixed methods study, we used quantitative methods to identify a cohort of hospitals with high, low, and highest improving ED lengths of stay for admitted patients, then sampled from these groups of hospitals for in-depth interviews. We sampled from a national cohort of hospitals that participate in the Centers for Medicare and Medicaid Services (CMS) reporting program for ED timeliness metrics.[21] CMS added ED timeliness measures to the hospital value based purchasing program in 2012, assessing a financial penalty to hospitals that did not report measures, including median ED length-of-stay (LOS) (measure ED-1b) and median boarding time (measure ED-2b) for patients who are admitted to the hospital for inpatient care.

We previously developed a risk adjustment methodology to facilitate comparisons of performance on CMS ED timeliness measures. For this study, we arrayed all hospitals according to their case mix adjusted[22] performance in 2012 and 2013. We identified three groups of interest: high performance, low performance, and high improver. High and low performance hospitals were defined as those in the top or bottom 5%, respectively, for both ED LOS and boarding time for admitted patients in 2012. “High improving” hospitals were defined as those with the top 7.5% improvement for both ED LOS and boarding time for admitted patients between 2012–2013.

We used a purposive sampling approach to recruit four hospitals in each of the three performance strata. Our sample hospitals were selected to represent diversity in characteristics that might impact strategies to reduce ED crowding within each strata. We matched hospitals across strata on region of country, urban/rural status, hospital occupancy, and annual ED admissions. We contacted the Chief Executive Officer and ED director of purposively selected hospitals. When requesting study participation, we did not disclose performance status. Using a ‘snowball’ approach, we asked the initial set of interviewees at each hospital to suggest additional key informants within their organization, such as administrative leadership of the hospital and people who are part of crowding and hospital flow task forces.

The study was conducted between January 2015 and June 2016. At the start of the study, only 2012 CMS data were available for identification and recruitment of high and low performance sites. We used subsequent CMS data from 2013 to identify high improver sites, as well as to verify the stability of high and low performance designation using 2012 data.

All study activities were approved by Oregon Health and Science University (OHSU) Institutional Review Board, and we followed the Standards for Reporting Qualitative Research.[23]

Methods and Measurements

We conducted in-depth interviews via telephone with key hospital informants, with an average of 5 interviews per hospital. Each interview was conducted by two experienced interviewers who were blinded to the performance level of the hospital. One interviewer

(AMC) was a board certified emergency physician with 6 years of academic and community practice experience, and the other interviewer (SK) was a qualitative research specialist who has studied clinic practice change for several years. A semi-structured interview guide was pilot tested within our hospital leadership and crowding committee experts, then iteratively refined during the course of the study (eAppendix 1). Interviews averaged one hour in duration, were audiotaped, and were professionally transcribed.

Analysis

A multidisciplinary team, including experts in emergency medicine, hospital administration, health policy, and organizational change, used a grounded theory approach to develop hypotheses.

We began with an open coding approach that involves examining the data to identify themes. The codes were then grouped into higher order categories. Analysis and coding of additional transcripts from new interviews were compared to previously coded data. We used ATLAS.ti software (Scientific Software Development GmbH) to facilitate review, analysis, and reporting of data.

We continued to analyze data as a group until the emerging codebook was stable (i.e., definitions of codes were no longer changing) and reliable (i.e. independent reviews of the same transcript yielded similar codes). Three study team members who were blinded to the performance status of each hospital (AMC, SK, DC) then completed initial coding of all transcripts. In addition, two team members (AMC, DC) examined all transcripts to identify specific strategies as characterized by interviewees.

The process of data collection, coding, and constant comparison continued until no new concepts were identified (‘theoretic saturation’).[24] These concepts were sorted, named, and grouped within our multidisciplinary team. After all data had been coded, hospital performance was revealed to the coders. To generate hypotheses about effective strategies, we performed additional analyses to assess how organizational practices varied by hospital performance level using a case comparison method of each strata.[25]

Results

There were 2,619 hospitals that reported both ED LOS and boarding time metrics to CMS Hospital Compare in 2012. Table 1 describes the characteristics of the 12 participating hospitals. ED LOS worsened from 2012–2013 for one of the four high performance hospitals (2% to 9% ranking), although risk adjusted performance remained in the top 10% for all measures in both years. Rankings were stable for all low performance hospitals. High improving hospitals demonstrated 14–58% absolute percentile rank increases on ED timeliness measures between 2012 and 2013. Hospitals that chose to participate were similar to hospitals that were invited but declined to participate (see eTable). We interviewed 60 staff members, including hospital executives, ED chairs and directors, nurse managers, and hospitalists (Table 2).

Hospital Crowding Leads to Emergency Department Crowding

Interviewees from all strata of hospital performance had a shared theoretical model of ED crowding: the lack of inpatient beds and disposition led to boarding of admitted patients in the ED. Inpatient boarding reduced the effective capacity of the ED to evaluate and treat new patients, which in turn led to ED crowding.

> When you get an emergency department functioning very well it really means that the hospital is functioning very well. Because if the back of the house has not really owned the emergency department patients to the degree that they do as an inpatient, it creates a certain amount of sluggishness in the system. *–Hospital 2, CEO*

With this understanding, hospitals across all strata addressed performance by using both within ED and hospital-wide interventions[19] to reduce ED crowding (Table 3). We did not find an obvious relationship between specific strategies utilized and hospital performance level; that is, there were no strategies that were consistently employed across high performing hospitals, or consistently not used in low performing hospitals. Rather than the selection of strategies, interviewees stressed that that difference was in how the organization supported the execution of a strategy.

> I think the biggest challenge is the execution. And in many areas the execution has not gone forward. Whether there's not a champion or the person who's championing it is not pushing hard enough, or there's no incentives or disincentive, really no carrot or stick to try to make things go.–Hospital 3, ED Chair.

Domains of Organizational Performance

Four broad domains characterized and differentiated participants' experiences in our study hospitals: executive leadership involvement; hospital-wide coordinated strategies; data driven management; and performance accountability (Table 4). High-performing and low performing hospitals differed markedly in each of these domains; high improver hospitals also demonstrated activity and engagement in these areas that approximated the approaches found in high-performing hospitals. We describe the domains and key themes in subsequent sections, with representative quotations from study participants. Table 4 contains additional quotations for each domain, stratified by hospital performance level.

Executive leadership involvement

In high performing hospitals, executive leaders identified hospital crowding as a top priority: they clearly articulated performance goals, provided resources to achieve these goals (e.g., capital equipment purchases, new physicians, nurses, and ancillary staff) and had leadership on the floor monitoring performance. For example, in Hospital 2, the CEO made it clearly defined a target metric: 80% of ED patients would be admitted or discharged within 3 hours. When leadership mapped out key processes to achieve these metrics, the hospital purchased a new CT and wireless connected ultrasounds to improve radiology turnaround times. Finally, executive leaders at this hospital were highly visible on the ground and led by example. As the CEO reported, "it was truly because [we] had a chief nurse executive that if these metrics weren't made, she was on the floor as well doing discharges, doing patient

care" (Hospital 2). Similar accounts of how executive leadership took an active role in reducing hospital crowding were identified in high performing hospitals.

In high improving hospitals, the impetus for change also started from the top. Hospital executive leadership laid the groundwork for these improvements, such as hiring consultants and new emergency department leadership to implement changes, building new operational leadership teams, and increasing ED and inpatient capacity.

In contrast, low performing hospital executive leadership did not prioritize crowding initiatives, despite acknowledging the causes. Emergency department leadership often felt isolated in their struggle with significant boarding and lengths of stay. Without senior leadership focus to improve ED crowding, low performing hospitals also reported that there was a lack of support to provide resources, including around the clock availability of advanced diagnostic testing, social workers, or case managers.

Hospital-wide coordinated strategies

High performing hospitals consistently adopted cross-departmental initiatives (e.g. ED, radiology, laboratory services, hospitalist, surgery, housekeeping, nursing) to alleviate crowding, and low performing hospitals rarely did. Participants from high performing hospitals reported that they developed processes and procedures that anticipated and addressed each step of the patient flow process. These were developed in multidisciplinary meetings and addressed the unique challenges that each hospital faced. As an example, Hospital 5 developed strategies for improving bed turnaround times on the inpatient units by working with inpatient medicine teams, bed management, transport, and environmental services.

> We [saw] what our barriers were for flow. And we literally tackled each and every one of the different factors. From the inpatient medicine side, we realized that our discharge planning and getting patients out of the hospital in a timely manner was pretty bad…That meant that we had to improve communication between the patients, the nursing staff, physician staff, care management staff…There was a lot of work also with our bed cleaning folks, our environmental associates. Instead of waiting for the room to go from dirty to clean and then to book transportation for a patient to come, we started doing things in parallel so that we would cut down on kind of waiting time. So a lot of work conducted with bed management. A lot of work with the cleaning folks, the environmental associates and a lot of work with transport.–*Hospital 5, Quality Director*

Similarly, high improver hospitals show a similar pattern of adopting interdepartmental strategies that address each step of patient flow. In contrast, low performing hospitals reported lack of buy-in for hospital-wide coordinated strategies. Despite initiatives, interviewees reported "turf wars" between services that delayed admission times.

> There's length of stay committee meetings that we go to. But a lot of that is just sort of hearing what people are working for and making some suggestions. But it's hard in the emergency department to affect change on the rest of the hospital except just trying to push this information out there, give them suggestions. But we still

got a lot of pushback. I had a meeting with our Chief Medical Officer this morning. And we talked about the initiatives they're trying to work on in overcrowding and how it still has not taken significant effect so that we're still stuck with all these problems in the ED.—Hospital 3, ED Chair.

Data driven management

High performing hospitals proactively used data to reduce ED crowding. Data were used in specific ways: 1. Changing behavior and plans in real time; 2. Feedback to personnel on specific cases; and 3. Predicting patterns of ED and hospital flow and matching resources to meet the needs of the hospital. Rather than relying on staff perceptions of hospital flow patterns, high performing hospitals examined previous years of hospital data to change bed and staffing patterns. High improving hospitals also reported that part of their improvement process included learning to collect, report, and use their data in efforts to improve ED crowding. High improving hospitals made real-time data available to all staff as a first step in their transformation. For example, one ED Director reported, "We actually have three computer screens in our hallway back by our break room that have data on there for our staff to see. So we like to be transparent. We like to be data-driven." (Hospital 11, Nursing Director)

In contrast, at low performing hospitals, data were most often available only retrospectively, and, if the data were used, they were discussed by executive leadership at monthly or quarterly meetings. Participants from low performing hospitals questioned the reliability and validity of the data they received and thus did not change practice based on these data.

Performance accountability

High performing hospitals had executive leadership who engaged staff across departments and service lines to impact crowding metrics. These hospitals relied on constant communication and active management to ensure that each service line was sharing the responsibility of throughput. Managers held staff accountable, and outliers were addressed immediately. For example, nursing leadership from Hospital 4 followed up with nurses the next day on cases where there were delays to inpatient admissions to delineate causes and possible solutions. This pattern was found in high improver hospitals, with feedback presented to all staff in a timely manner, and accountability for performance continuously monitored.

In contrast, low performing hospitals often had services and departments that were siloed and did not have accountability for throughput from the ED. There was a "lack of disposition on the admitted side" (Hospital 3, Nursing Director) without responsibility for these behaviors. For example, staff at one hospital reported that their leadership wanted patients to be discharged prior to 11am; however, with many private inpatient physicians, it felt like merely a "suggestion" without reinforcement of the policy, and the majority of discharges still occurred after 4pm.

Limitations

Our study has several limitations. First, due to delays in published CMS metrics, we defined performance groups based on 2012–2013 data. Although it is possible that our rankings do not reflect current performance, we found that performance rankings were unchanged into the most recently available 2014 data (not shown). Second, we studied 12 of over 2,600 hospitals participating in CMS reporting of ED throughput metrics. There is potential for reciprocal determination from our interviewees in those who knew their LOS metrics would reinforce this notion within their interviews by providing post hoc explanations versus the actual unmeasured factors. In addition, senior executives were not interviewed at many low performing hospitals, potentially not participating because they knew of their low performance. We also cannot prove causality, but only association of these organizational characteristics with performance, but in interviewing the high improving hospitals, they highlighted these organizational characteristics as changes that were made.

Discussion

To our knowledge, this is the first study to use a “positive deviance” approach to understand how high performance hospitals reduce ED crowding.[20] Our findings are further strengthened by the inclusion of a low performance comparison group, as well as high improver hospitals to validate findings. Despite varying performance levels, all respondents shared a common explanatory model of ED crowding as a symptom of inpatient crowding. Importantly, we did not find that specific interventions were related to performance level. Reported interventions overlapped considerably by performance level; for example, the use of “LEAN” quality improvement processes[26] was reported by all hospitals across performance groups. This finding is consistent with systematic reviews that documented heterogeneity of ED crowding interventions and their effectiveness.[15,19,27–29] A potential explanation is that the specific factors driving ED crowding vary by hospital, and the “optimal” approach depends on local causes and resources. Furthermore, success of programs is likely to be highly dependent on the process of identifying causes of crowding and addressing them in sustainable ways, and our high performing hospitals give examples of how they were able to do so.

We identified distinct organizational characteristics associated with high or improving performance, including executive leadership involvement, hospital-wide coordinated strategies, data driven management, and performance accountability. These organizational characteristics tended to manifest in high performing hospitals, while the opposite was true in low performing hospitals. Of note, one marked difference between high and low performing hospitals were the number of hospital executives who agreed to participate in our study, which indicates also lack of leadership involvement.

Our findings are consistent with prior multisite studies of ED crowding interventions. The Urgent Matters learning networks included 16 hospitals that implemented multiple initiatives to reduce ED crowding.[19] The networks identified seven organizational factors that were pre-requisites to success, regardless of specific interventions: 1. Recognition of ED crowding as a hospital-wide problem; 2. Culture of transparency; 3. Multi-disciplinary,

hospital-wide teams to drive quality improvement; 4. Support of top management; 5. Recruitment of a local “champion”; 6. Using formal improvement methods; and 7. Commitment to rigorous metrics. Additionally, the Aligning Forces for Quality program included 28 hospitals that participated in an ED throughput improvement program.[15] These findings and ours suggest that organizational factors are an integral part of ED length of stay metrics and driving change, and now are able to give specific examples of how these were implemented or not within hospitals of varying performance level. Additionally, we are able to correlate these changes with nationally reported length of stay metrics.

Our study, and the experiences provided by the literature, suggest that interventions are associated with successful implementation if the following are present: ED crowding is a priority for hospital leadership; if the intervention is based on a hospital-wide solution; if data are used to monitor progress; and if there is accountability at the clinical and managerial levers for performance on ED crowding metrics. We are able to provide illustrations of how these characteristics are manifest in high and low performing hospitals, and how high improving hospitals were starting to change. Having a hospital-wide culture of these characteristics are more important than the actual interventions. As another example, a recent Canadian initiative to reduce ED crowding included the implementation of 44 discrete interventions to improve patient flow. Interviews with hospital managers revealed a common theme- the lack of a coherent system-wide strategy led to flawed interventions and implementation, and failed to reduce ED crowding.[15] As a next step as part of a positive deviance approach, we plan to use the data to develop a survey that queries these domains in a larger sample of hospitals to verify our findings.

In summary, we found that high performance on ED crowding metrics is associated with specific organizational characteristics, including executive leadership involvement, hospital-wide coordinated strategies, data driven management, and performance accountability. In addition, specific types of interventions do not appear to be associated with hospital performance, rather, it is the interplay of organizational characteristics that make for successful implementation of strategies. Attempts to reduce ED crowding have a strong organizational culture; rather adopting “generic” approaches, interventions should be selected and implemented to address the unique challenges of each hospital.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported by National Institutes of Health (NIH) grant R21AG044607 (Dr. Sun). Dr. Chang was supported by NIH grant K12HL108974.

The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript. The contents do not necessarily represent the official views of the National Institutes of Health.

APPENDIX 1: INTERVIEW GUIDE – IRB # 8703

Identifying Hospital Practices to Reduce Emergency Department Crowding Interview Guide

Consent Process & Opening Script

A detailed information sheet covering the critical elements of consent will be emailed to all participants prior to the interview. Please have a copy of the information sheet with you. Hand this to the study participant, give them a moment to review it, and ask them if they have any questions. Below is a summary of the consent information to be conveyed to the participant before conducting the interview.

- Thank you so much for your time today and for agreeing by email to participate in this interview. You have been invited to be in this research study because you have been identified as being a key member of your hospital's efforts to reduce emergency department (ED) crowding. The purpose of this study is to learn about how to reduce ED crowding. From this information we will develop a survey tool to measure hospital practices aimed at reducing ED crowding.
- You will be asked about your role and experiences in reducing ED crowding at your hospital. The interview will last approximately one hour.
- Do you have any questions about the information on the information sheet?
- We would like to record this interview for the purpose of data analysis. Having a recording allows us have the interview professionally transcribed and helps study what participants say so that we can identify important concepts.
- We will not be collecting identifiable information so there is little chance of breach of confidentiality. The information you give us is completely confidential.
- You do not have to participate in this or any research study. If you do decide to participate, and later change your mind, you may quit at any time. If you refuse to participate or withdraw early from the study, there will be no penalty or loss of any benefits to which you are otherwise entitled.
- Is it okay to record this interview?
- If the participant says yes, please explain that you will also ask for the participant's verbal consent to record the interview once you have turned on the recorder. Turn on the audio recording device and ask: "Is it okay to record this interview" and have the participant confirm. Then you can begin the interview.

Lead interviewee—Please introduce yourself to the participant. Tell them about your background, the institution where you work, what your role is at OHSU, how long you have worked at OHSU and have been doing your job, and what other places you have worked. Then, introduce the second interviewer and have this person do the same introduction.

1 Please tell me about yourself and your role with the emergency department?

Probes:

- What are your responsibilities?
- How long have you worked here?
- How long have you been doing this type of job?

We're going to start by talking a bit about your specific department's experiences with emergency department crowding.

2 Can you tell me about a recent experience with a crowded emergency department?

Please walk me through this experience telling me as much as you can about what happened and why.

Interviewer: Please let the interviewee finish. Then, probe as needed to get a full understanding of the ED crowding experience.

3 How does your department define a crowded emergency department?

4 How does your department measure crowding?

5 Does your department have set targets for ED crowding metrics? If yes…

Probes:

- How are these targets set?
- How are these targets monitored?
- When your ED is outside of these targets, how does your department respond?

Now, I'd like to shift gears a little bit and talk about the strategies the hospital uses to manage ED crowding.

6 What strategies does your hospital use to reduce emergency department crowding?

Probes:

- How was the protocol developed?
- How was the protocol implemented?
- What were the steps or sequence in the change process
- Who led that change effort?

Some examples may include lean methodology or variance control

7 How does your hospital know if these strategies are being implemented?

8 How does your hospital know if these strategies are working?

9 Does your hospital have set targets for ED crowding metrics? If yes…

Probes:

- How are these targets set?

- How are these targets monitored?
- When your ED is outside of these targets, how does your hospital respond?
- How were the effects of this change monitored?

10 What techniques does your hospital use to incentivize follow-through on these strategies?

Probes:

- When your ED is outside of these targets, how does your institution respond?
- Probe about:
- Provider incentives
- Pay for performance

Our final few questions come back to your experiences with the emergency department crowding.

11 What lessons have you learned about trying to reduce emergency department crowding?

12 What factors shape your efforts to reduce emergency department crowding?

Probes:

- Probe about each factor & their role in ED crowding
- What other internal factors shape efforts to reduce emergency department crowding?
  - Responsiveness of the lab
  - Responsiveness of imaging
  - Responsiveness of consult
  - Bed availability
  - Scheduled medical admissions
  - Scheduled surgical admissions
  - Outside hospital transfers
  - Outside hospital referrals
  - Home health services
  - Triage process
  - Inpatient boarding
  - Hospital level coordination of inpatient bed availability

- What other external factors shape efforts to reduce emergency department crowding?
  - Local geography
  - Market
  - Outpatient services
  - Patient demand

13 Our goal is to understand the strategies that hospitals use to reduce emergency department crowding. What else is important to understanding how your hospital manages emergency department crowding?

14 Is there anything specific you think could be or should be done to reduce ED crowding?

15 Are there other staff members involved in efforts to reduce emergency department crowding who we should speak with? **[Interviewer: If yes, please get the name of these people.]**

References

1. Hospital-Based Emergency Care: At the Breaking Point - Institute of Medicine. http://www.iom.edu/Reports/2006/Hospital-Based-Emergency-Care-At-the-Breaking-Point.aspx. Accessed September 29, 2011
2. Emergency Medicine Practice Committee. Emergency Department Crowding: High Impact Solutions. May. 2016 https://www.acep.org/Content.aspx?id=32050. Accessed November 7, 2016
3. Hoot NR, Aronsky D. Systematic Review of Emergency Department Crowding: Causes, Effects, and Solutions. Ann Emerg Med. 2008; 52(2):126–136.e1. DOI: 10.1016/j.annemergmed.2008.03.014 [PubMed: 18433933]
4. 27 MCCNJ, 2014, Pm 4:22.Man found dead in NYC hospital waiting room more than 8 hours after entering. http://www.cbsnews.com/news/man-found-dead-in-st-barnabas-hospital-waiting-room-8-hours/. Accessed November 7, 2016
5. NAMCS/NHAMCS - Ambulatory Health Care Data Homepage. https://www.cdc.gov/nchs/ahcd/. Accessed May 2, 2017
6. FastStats. http://www.cdc.gov/nchs/fastats/emergency-department.htm. Accessed November 7, 2016
7. Sun BC, Hsia RY, Weiss RE, et al. Effect of emergency department crowding on outcomes of admitted patients. Ann Emerg Med. 2013; 61(6):605–611.e6. DOI: 10.1016/j.annemergmed.2012.10.026 [PubMed: 23218508]
8. Sun BC, Binstadt ES, Pelletier A, Camargo CA. Characteristics and temporal trends of “left before being seen” visits in US emergency departments, 1995–2002. J Emerg Med. 2007; 32(2):211–215. DOI: 10.1016/j.jemermed.2006.05.045 [PubMed: 17307641]
9. Pines JM, Pollack CV, Diercks DB, Chang AM, Shofer FS, Hollander JE. The association between emergency department crowding and adverse cardiovascular outcomes in patients with chest pain. Acad Emerg Med Off J Soc Acad Emerg Med. 2009; 16(7):617–625. DOI: 10.1111/j.1553-2712.2009.00456.x
10. Pines JM, Hollander JE. Emergency department crowding is associated with poor care for patients with severe pain. Ann Emerg Med. 2008; 51(1):1–5. DOI: 10.1016/j.annemergmed.2007.07.008 [PubMed: 17913299]
11. Pines JM, McCarthy ML. Executive Summary: Interventions to Improve Quality in the Crowded Emergency Department. Acad Emerg Med. 2011; 18(12):1229–1233. DOI: 10.1111/j.1553-2712.2011.01228.x [PubMed: 22168183]

12. Viccellio A, Santora C, Singer AJ, Thode HC, Henry MC. The association between transfer of emergency department boarders to inpatient hallways and mortality: a 4-year experience. Ann Emerg Med. 2009; 54(4):487–491. DOI: 10.1016/j.annemergmed.2009.03.005 [PubMed: 19345442]
13. Howell E, Bessman E, Kravet S, Kolodner K, Marshall R, Wright S. Active bed management by hospitalists and emergency department throughput. Ann Intern Med. 2008; 149(11):804–811. [PubMed: 19047027]
14. Howell E, Bessman E, Marshall R, Wright S. Hospitalist bed management effecting throughput from the emergency department to the intensive care unit. J Crit Care. 2010; 25(2):184–189. DOI: 10.1016/j.jcrc.2009.08.004 [PubMed: 19828284]
15. Zocchi MS, McClelland MS, Pines JM. Increasing Throughput: Results from a 42-Hospital Collaborative to Improve Emergency Department Flow. Jt Comm J Qual Patient Saf. 2015; 41(12): 532–553. [PubMed: 26567143]
16. Vermeulen MJ, Ray JG, Bell C, Cayen B, Stukel TA, Schull MJ. Disequilibrium between admitted and discharged hospitalized patients affects emergency department length of stay. Ann Emerg Med. 2009; 54(6):794–804. DOI: 10.1016/j.annemergmed.2009.04.017 [PubMed: 19556025]
17. Kreindler SA. Six ways not to improve patient flow: a qualitative study. BMJ Qual Saf. 2017; 26(5):388–394. DOI: 10.1136/bmjqs-2016-005438
18. Warner LSH, Pines JM, Chambers JG, Schuur JD. The Most Crowded US Hospital Emergency Departments Did Not Adopt Effective Interventions To Improve Flow, 2007–10. Health Aff (Millwood). 2015; 34(12):2151–2159. DOI: 10.1377/hlthaff.2015.0603 [PubMed: 26643637]
19. McClelland MS, Lazar D, Sears V, Wilson M, Siegel B, Pines JM. The past, present, and future of urgent matters: lessons learned from a decade of emergency department flow improvement. Acad Emerg Med Off J Soc Acad Emerg Med. 2011; 18(12):1392–1399. DOI: 10.1111/j.1553-2712.2011.01229.x
20. Bradley EH, Curry LA, Ramanadhan S, Rowe L, Nembhard IM, Krumholz HM. Research in action: using positive deviance to improve quality of health care. Implement Sci. 2009; 4:25.doi: 10.1186/1748-5908-4-25 [PubMed: 19426507]
21. Centers for Medicare and Medicaid Services. CMS Case Mix Index: Details. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Acute-Inpatient-Files-for-Download-Items/CMS022630.html. Published April 7, 2016. Accessed May 11, 2017
22. Sun BC, Laurie A, Prewitt L, et al. Risk-Adjusted Variation of Publicly Reported Emergency Department Timeliness Measures. Ann Emerg Med.
23. O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for Reporting Qualitative Research: A Synthesis of Recommendations. Acad Med. 2014; 89(9):1245–1251. DOI: 10.1097/ACM.0000000000000388 [PubMed: 24979285]
24. Glaser BG. Conceptualization: On Theory and Theorizing Using Grounded Theory. Int J Qual Methods. 2002; 1(2):23–38.
25. Baxter P, Jack S. Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. Qual Rep. 2008; 13(4):544–559.
26. Dickson EW, Anguelov Z, Vetterick D, Eller A, Singh S. Use of lean in the emergency department: a case series of 4 hospitals. Ann Emerg Med. 2009; 54(4):504–510. DOI: 10.1016/j.annemergmed.2009.03.024 [PubMed: 19423187]
27. Oredsson S, Jonsson H, Rognes J, et al. A systematic review of triage-related interventions to improve patient flow in emergency departments. Scand J Trauma Resusc Emerg Med. 2011; 19:43.doi: 10.1186/1757-7241-19-43 [PubMed: 21771339]
28. Robinson DJ. An integrative review: triage protocols and the effect on ED length of stay. J Emerg Nurs JEN Off Publ Emerg Dep Nurses Assoc. 2013; 39(4):398–408. DOI: 10.1016/j.jen.2011.12.016
29. Morgan SR, Chang AM, Alqatari M, Pines JM. Non-emergency department interventions to reduce ED utilization: a systematic review. Acad Emerg Med Off J Soc Acad Emerg Med. 2013; 20(10): 969–985. DOI: 10.1111/acem.12219

Table 1

Characteristics of Participating Hospitals

Hospital Region	Service Area	Ownership	Trauma Center	Has residency programs	Hospital Occupancy, percent	Median household income	Case Mix Index, Quartile	Annual ED Volume	Annual ED Admissions	Average Time in ED before admitted, 2012 (min)	Average Time in ED before admitted, 2013 (min)	Average time in ED after decision to admit before leaving for inpatient bed, 2012 (min)	Average time in ED after decision to admit before leaving for inpatient bed, 2013 (min)
High Performers													
South	Metro	NFP	Y	N	65	$32,000	3	172,000	37,00	170	170	30	80
NE	Metro	NFP	N	N	75	$54,000	2	35,000	8,000	220	220	50	50
NE	Metro	NFP	Y	Y	82	$43,000	4	141,000	54,000	300	310	100	110
West	Rural	NFP	N	N	38	$60,000	2	25,000	3,000	150	140	40	40
Low Performers													
South	Metro	NFP	Y	Y	84	$66,000	4	91,000	38,000	540	540	260	280
West	Rural	NFP	N	N	61	$36,000	3	20,000	6,000	430	430	220	230
S	Metro	NFP	Y	Y	85	$31,000	4	71,000	37,000	640	660	340	381
West	Metro	Govt	Y	Y	79	$42,000	2	126,000	24,000	680	550	430	370
High Improvers													
West	Metro	Govt	Y	Y	83	**	4	74,000	26,000	350	280	130	80
MW	Metro	NFP	Y	N	46	$72,000	4	70,000	28,000	250	210	140	70
NE	Metro	NFP	Y	Y	74	**	4	127,000	13,000	470	360	290	210
NE	Rural	NFP	Y	N	75	$47,000	4	29,000	14,000	440	300	230	120

NFP: Not for profit, Govt: government

Trauma Center: Y if Level I/II

Case Mix Index: The CMI of a hospital reflects the diversity, clinical complexity and the needs for resources in the population of all the patients in the hospital[21]

*Median household income by zip code (2011–2015 American Community Survey 5-Year Estimates)

** Estimates not available for all zip codes

Table 2

Type of Staff Interviewed at Hospitals

	Total	High	Improver	Low
Hospital Executive/Vice President	16	9	5	2
Bed Czar/Patient Placement Center	7	1	3	3
ED/Emergency Services Leadership–Physician	22	7	7	8
ED/Emergency Services Leadership–Nursing	9	3	3	3
Internal Medicine/Hospitalist	6	1	1	4
Total	60	21	19	20

Table 3

Number of hospitals in each strata that implemented specific protocols and processes to decrease crowding

Intervention	High	Low	Improver
ED-based interventions			
Bedside registration		1	
Electronic tracking and dashboard	2	2	3
Protocols initiated in triage	1	1	2
Point of care lab testing	1	1	1
Provider zones	1	2	
Fast track area	1	2	2
Changing staffing patterns or increasing staffing	2	2	2
Observation unit			1
New ED Leadership	2	2	1
Provider in triage		3	2
Bridging orders for admission	1	1	1
Expansion space	1	1	2
Separate psychiatric space	1	1	
Hospital-based interventions[*]			
Inpatient bed tracking center with bed czar	3	2	2
Early discharge times	1	2	2
When full, ambulance diversion and outside hospital transfers delayed	1	1	
Bed ahead/pull to full	3	1	1
Electronic handoff reports	1		1
Nursing pools to help when ED crowded	1	1	
Boarding patients to inpatient hallways		1	1
Moving patients to affiliated hospitals	1		1
New hospital leadership	2	4	4
Hospital wide morning huddle	1	4	3
LEAN consultants	2	3	2
Transport/Housekeeping alerts to move and turnover beds	3	1	1
Prioritizing ED studies (CT/MRI/lab)	1		1

[*] none of the participating hospitals reported interventions to smooth scheduling of surgeries or other elective procedures

Table 4

Quotes that exemplified responses from high, low, and improver hospitals

ED Crowding as an Organizational Priority	High	It was led by the ED leadership of both nurses and physicians, but strong oversight by the CEO and the CNO, because they then had to report to the Board. So, we drove it, mostly because it was very clear to us that there was an expectation that we would meet it. —Hospital 2, VP Clinical Operations
	Improver	We had just been going through a strategic plan for our health organization, our health system and identified improving the ED, or what we called the ED transformation as the number one strategic objective for the organization. So when it was defined by the Board and the CEO as the number one strategic objective, and then given to me and my time, it was actually kind of easy because the barriers that you have in improving ED throughput, it's hard to argue when you say, well, I don't understand how you can't do x, y or z. This is the number one driving strategy of the organization. Let's make it happen. So it's a little easier to do when you get that kind of high level support all the way up to the Board. —Hospital 12, VP Clinical Operations
	Low	But I have no real influence outside of my department. One of the things I would say I've learned is that until the senior administration is interested in having changes occur, changes will not occur. these things need to be led from the top down. And it needs to start with the CEO and the Vice Presidents…Or it won't happen.—Hospital 7, ED Medical Director
Hospital wide - coordination of strategies	High	If we're not getting results either via medical imaging or via the lab, if it's taking more than thirty minutes to get results, we are supposed to contact the medical imaging department as well as the lab. They can send someone from phlebotomy to help this lab job. And they can activate another tech from medical imaging to help try to transport patients back and forth to medical imaging… If the patients are put back in the emergency department and have not been seen by a provider for thirty minutes, the coordinator is supposed to directly speak to the physician. –Hospital 4, Medical Director
	Improver	We're very clearly targeting getting patients out of the hospital by eleven o'clock in the morning, with the secondary target of two o'clock in the afternoon. That's kind of the busiest times of the day. And we find the earlier we start our day to get patients moving. We also have kind of a listing and a group that goes around and looks for delays in care. Anything that we can do to push patients…testing and procedures earlier will obviously help us clear out the beds in the emergency room for the mid-afternoon and late afternoon rush. —Hospital 10, Hospitalist Director
	Low	The hospital's decision is that under circumstances like that, the ER will simply back up. There's no call system for inpatient nursing to bring in additional staff. I don't know that they implemented any [strategies] to deal with ER crowding.—Hospital 7, Medical Director
Data Driven Management	High	The data [are] posted. Every day the ED Director takes the volume and the time in. We can break the physician data down by physician. We can break it down by nurse. And we hold people accountable. hey [nurse], talk to me. Tell me what happened yesterday. —Hospital 4, VP Nursing
	Improver	We looked at data extensively, which hadn't been done before. So we looked at arrival trends. And we looked at volumes. And we started to figure out how to staff to…not just staff to arrivals, which traditionally EDs do, but to staff to arrivals plus the population that's already in the department so… basically, ED staff to the flow of patients coming in the front door. But they never account for the people that already in beds. So traditionally what it looks like is you're staffing two hours too late in the day. —Hospital 11, Process Improvement Director
	Low	And turn around time to admission…That's been a little harder to benchmark. As well as the fact that we don't really have a functional EMR, and so that's manually calculated… that's been a little elusive. So we've been looking actually time from admission to time actually going upstairs for admitted patients. And that's quite a long…Also tracking it and trying to get it down.—Hospital 8, Medical Director
Performance Accountability	High	Everybody had their part and was expected to report out on what they were going to do, changing their behavior. —Hospital 5, Quality Director
	Improver	One of the first things we did was give all the individual providers their feedback, individually, on their ED length of stays, their door to doc times. And we also showed where they ranked amongst their peers. And we would give this to them every month and then also a quarterly summary. And I would meet with them individually for the outliers to identify issues why they were kind of outlying and not being as efficient as some of the other providers. We could identify hurdles and barriers and try and break those down. So I think that was also a major impact in our ED throughput. —Hospital 9, ED Director
	Low	It's one of those things where sometimes you're like trying to turn the Queen Mary with a rowboat,. Unfortunately, and some people view it in terms of dictating their practice. But we get pushback like that. –Hospital 3, Nursing Supervisor