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Original Research

Significant Reduction of Emergency Department Wait Time Correlates to Improvements in Patient Satisfaction and Yelp Ratings

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▌ ABSTRACT ▌

Background
The Emergency Department (ED) is an integral component of community hospitals and provides imperative health care services to the community. However, ED crowding has become a major public health issue that hinders the community from receiving quality emergency care.

Objectives
The purpose of this study is to evaluate the impact of a LEAN-based intervention on ED performance and patient experience.

Methods
The study utilized a six month pre- and post-study design to evaluate the changes in ED throughput measures. Metrics used to measure impact of the study were door to doctor time, Length of Stay (LOS), and percent of patients who left without being seen (% Left Without Being Seen, LWBS). Moreover, the study assessed changes in patient experience using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey to capture the large number of patients who were admitted as well as Yelp star rating and comments.

Results
The hospital observed significant reductions in median LOS from 106- to 77-minutes, door to doctor time from 15- to 10-minutes, and % LWBS rates from 2.78% to 0.10%. Gradual increase was observed in both HCAHPS top box scores and Yelp star ratings.

Conclusion
LEAN thinking facilitates the staff to tailor the interventions to patients' needs. As healthcare moves into a patient-centered care era, social media and patient satisfaction surveys serve as invaluable platforms to engage patients with the intent of improving ED care.

Keywords
Emergency department; Patient satisfaction; Social media; Patient experience.

INTRODUCTION

The Emergency Department (ED) is an integral component of a community hospital. ED offers immediate and round-the-clock health care access to the community.[1] More than half of urban hospital EDs reported that they are at or above capacity in a 2010 survey.[2] Previous studies have established linkage between ED crowding and compromised quality of care, patient safety, patient experience, and increased mortality.[3,4] An efficient patient throughput strategy is crucial to reduce crowding. Providers and nurses are encouraged to take patients' preferences into care decisions[5] to achieve better medication adherence, disease management, and outcomes.[5,6]

Hospitals are looking for strategies beyond standardized surveys to engage their patients and improve their care. For example, Yelp was founded in 2004 and has since become one of the most popular online rating sites[7] which allow customers to post their reviews and submit star ratings on local businesses. While Yelp reviews are subjective, these reviews often reveal additional insights, such as patient perspectives and treatment of family members that are not captured by the current survey.[8,9] Social media is a plausible channel for hospitals to engage their communities and improve operations based on patient feedback.[9,10]

Similar to other U.S. hospitals, [facility], a medium-sized community hospital, is facing the crisis of ED crowding. The expanded coverage of the Affordable Care Act (ACA) placed tremendous stress on a 9-bed ED and created an urgency to improve throughput. By analyzing throughput and patient experience data, a multidisciplinary team identified significant bottlenecks in the process and determined ED boarded patients reduced ED capacity. The hospital began the ED initiative in January 2016 using LEAN methodology to reduce wait times, number of LWBS, and improve patient satisfaction. The purpose of this study is to evaluate the impact of an ED process improvement initiative on ED performance and patient experience.

METHODS

Study Design

This study utilized a pre- and post-study design to evaluate a LEAN intervention on ED performance and patient experience. The data was collected from the ED of MPH. MPH is located in the city [omitted] which has a population of 60,000 in Los Angeles County, California. MPH currently has over 250 affiliated physicians, 600 employees, and an annual ED visit of approximately 20,000. Almost 80% of MPH's inpatient census is admitted from the ED. MPH is accredited by The Joint Commission (TJC) and has received the Top Performer on Joint Commission Key Quality Measures Award in 2015.

ED Initiative

The LEAN implementation at MPH was a part of a system-wide ED initiative for a 7-hospital system to achieve reduction in ED throughput times and improvement in patient satisfaction. LEAN

methodology has emerged as an effective tool to improve ED patient throughput[11] by delivering increased value to the customer *via* key processes in which waste was eliminated. LEAN implementation is contingent upon the collaboration between leadership and frontline staff to create an organizational culture that adapts to patient demands.[12,13] MPH assembled a multidisciplinary team which included administrators, physicians, midlevel providers, directors, nurses, and ancillary staff. Weekly meetings allowed the team members to collect data that highlighted opportunities to better serve patients. The data revealed that after the decision to admit was made by the ED doctor, delays in bed assignments and a lengthy hand off process created ED throughput delays and a decrease in patient satisfaction. MPH then focused their intervention on decreasing patient boarding times, decreasing total LOS, and increasing patient satisfaction.

Communication disruption, lack of standardized procedures, and unnecessary rework were identified as the causes of delays. It was found that communication disruption, such as an inability to reach the house supervisor or primary care physicians often delay bed turnaround and ED patient transfer. The LEAN team worked together with staff to update the chain of command to identify alternative administrators or physicians to facilitate decision-making. Moreover, standardized operating procedures were created to improve coordination in bed control and assignment. In the new process, charge nurses are designated to receive the patient when the floor nurse is unavailable. Notably, the team also collaborated with bed control and the house supervisor to clarify essential criteria for patient placement, such as gender, isolation status, and fall-risk, level of care to reduce opportunities of mismatched patient placement. Lastly, rework was identified and hospital-wide changes were made to create an efficient transition from ED to inpatient (Table 1). Streamlining the decision to admit process was a joint effort between the ED and hospital wide.

Table 1. *Changes Made Hospital-Wide*

Conflict	Solution
MD not calling back in a timely manner	Nurses to follow chain of command
Bed not available	Room cleaning procedure based on isolation or not
	Have an assigned coordinator to communicate to in house staff
	Room number only released to ED staff once it is 100% ready
	Eliminate charge nurse's role in bed assignment. Only nursing supervisor assigns bed
	Standardize bed assignment checklist
Equipment	Purchase 10 Tele Box units
	Remove and replace defective IV poles
Bed reassignment	Conduct bed huddles when there is an increase in census
Lack of standardized process for discharge on system	Housekeeping communicate to bed control
	case management helps with D/C
Moving Patient out of ED after bed assignment	Treat admission patients as priority
	Unit charge nurse accepts patient from ER RN
	Designated transport team with nurse
	Nurse float pool: scheduled to work during peak admission hours

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Measures

ED throughput measures: ED performance was evaluated using three ED throughput measures: LOS, door to doctor time, and percent of LWBS patients. Median LOS was measured as a continuous variable in minutes from the time of registration to the time of departure from the ED. Door to doctor time was measured from the patient's ED arrival until the patient was seen by a provider. This study reported the median time as requested by the CMS. The percent of LWBS was calculated by dividing the number of LWBS patients by the total census.

Patient experience measures: Patient experience was measured by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey and Yelp star ratings. HCAHPS is a standardized survey of patients' perspectives of hospital care mandated by CMS. HCAHPS was selected as a measure because this intervention focused on facilitating ED admission process and ED focused survey excludes admitted patients. Currently, HCAHPS has 32 questions and all questions have Likert-type scale responses ranging from one (never or strongly disagree) to four (always or strongly agree). Only patients who responded with the highest mark (always or strongly agree) will be considered in the CMS-required top box percent.

HCAHPS results were further analyzed to include the results to question AJ, "During this hospital stay, were you admitted to this hospital through the Emergency Room?" The pre-intervention period of July 2015 through December 2015 had 296 (70.14%) respondents report yes and the post-intervention period respondents had 213 (76.07%) report yes to being admitted from the ED. The top box score results were compared to each other to assess if there was any significant difference.

Yelp reviews are written from the patient's perception of their experience at the facility. Social media has shown great potentials to reach large number of users in real time.[14-16] Yelp reviews consist of two different aspects: a 5-star rating and patient comments.

Inclusion and Exclusion Criteria

Patients presented at the ED during the study periods were included in the current analysis except for patients with a primary diagnosis of psychiatric conditions as defined by CMS. Incomplete (patients who left against medical advice or eloped) or incorrect medical records defined as any of the following were also excluded for the analysis:

1. Arrival to triage time less than or equal to zero;
2. Arrival to Medical Screening Exam (MSE) time less than or equal to zero;
3. Triage to MSE equal to zero*;
4. MSE to Disposition time less than or equal to zero;
5. Disposition to admit, discharge, or transfer time less than or equal to zero;

*Negative numbers indicate the physician or mid-level provider has performed the MSE before triage completion

Data Collection

Basic demographics and ED throughput measures: The data was collected retrospectively from the Electronic Medical Record (EMR) system and the ED portal. The ED portal was created by the Information Technology (IT) team in conjunction with the ED initiative to provide real-time data for key performance measures. Time stamps from the portal were used to compute door to doctor times and total LOS times. Patient records extracted from the EMR were used to determine the % LWBS. Depending on patients' condition, ED physicians may choose to 1) discharge the patient from the ED, 2) transfer the patient to another facility for more appropriate levels of care, or 3) admit the patient.

Patient experience data: HCAHPS data from before and after the intervention was retrieved from J.L. Morgan. A total of 748 patients completed the surveys; 451 patients responded from July to December 2015 and 297 patients responded from July to December 2016. In addition, Yelp reviews for MPH were extracted on 1/19/17 and 1/20/17 for the study period. There were a total of 53 Yelp reviews from before and after the LEAN implementation.

Primary data analysis: This study used a paired T-test to compare ED throughput measures, including average ED total LOS, door to doctor time, and percent of LWBS between "Pre-Intervention" (July 2015 to December 2015) to "Post-Intervention" (July 2016 to December 2016). We compared pre- and post-lean LOS and door to doctor time with paired t-tests.

For patient experience metrics, significant testing was performed for HCAHPS data. Paired t-test was used to compare the difference between Yelp star ratings and ED-related star ratings pre- and post-intervention. The monthly average for Yelp star rating and HCAHPS aggregate publicly reported top box% were included to observe overall trends.

RESULTS

Characteristics of Study Subjects

Demographic characteristics of the study in both groups were similar (Table 2). A total of 9,104 ED visits met inclusion criteria, with 3,725 visits in the pre-intervention group and 5,379 visits in the post-intervention group. There was no significant difference between pre- and post-intervention groups in age, sex, disposition type, relationship status, and financial class.

ED Throughput Measures by Disposition

The unadjusted difference between pre- and post-lean was statistically significant for LOS and door to doctor time. The mean LOS was 151 minutes compared to 113 minutes post-lean ($p < 0.01$). The door to doctor time was an average of 34 minutes compared to 13 minutes post-lean ($p < 0.01$). The percentage of LWBS patients from the ED decreased from 2.78% to 0.10%.

Table 2. *Demographic Descriptive Results for Sample Comparison*

Characteristic	Pre-Intervention (July – December 2015)	Post-Intervention (July – December 2016)
No. of Patient visits	3725	5379
ESI level, n (%)		
Level 1	5.0%	4.0%
Level 2	2.4%	1.7%
Level 3	50.1%	65.4%
Level 4	41.6%	26.6%
Level 5	3.8%	3.9%
Age		
0-5	10.9%	12.3%
6-17	13.3%	13.8%
18-44	39.3%	41.7%
45-64	21.7%	18.9%
65-79	8.2%	7.2%
>= 80	5.3%	4.8%
Gender		
Female	59.4%	59.2%
Male	40.6%	40.8%
Disposition		
Admitted	12.1%	13.4%
Home	83.0%	82.1%
Transferred	1.4%	1.2%
Relationship Status		
Married	28.4%	27.0%
Single	62.1%	64.1%
Financial Class		
Medicare	10.4%	9.7%
Medi-Cal	17.6%	17.3%
Medicare Managed Care	8.9%	8.1%
Medi-Cal Managed Care	32.3%	34.1%

Table 3. *MPH ED Performance Compared to California and National Benchmark*

	MPH Median July 2015 - Dec 2015	MPH Median July 2016 - Dec 2016	MPH Median FY 2016	MPH Median April 2015 - March 2016	California Median	National Median
LWBS	0.05%	0.01%	0.01%	3%	3%	3%
Patients spent in the emergency department, after the doctor decided to admt them as an inpatient before leaving the emergency department for their inpatient room (Dispo to A/D/T)	18	16	17	72	90	58
Patients spent in the emergency department before leaving from their visit (LOS)	106	77	80	110	134	113
Patients spent in the emergency department before they were seen by a healthcare professional (Arrival to MSE)	15	5	10	21	21	18

Based on CMS data, the ED overall performance was above both national and California averages despite a 44% increase in census between 2015 and 2016 (Table 3). Furthermore, a significant decrease in both median door to doctor time and total ED LOS were observed in all three disposition types (i.e., admit, discharge, and transfer) (Table 4). Against a 56% increase in the number of ad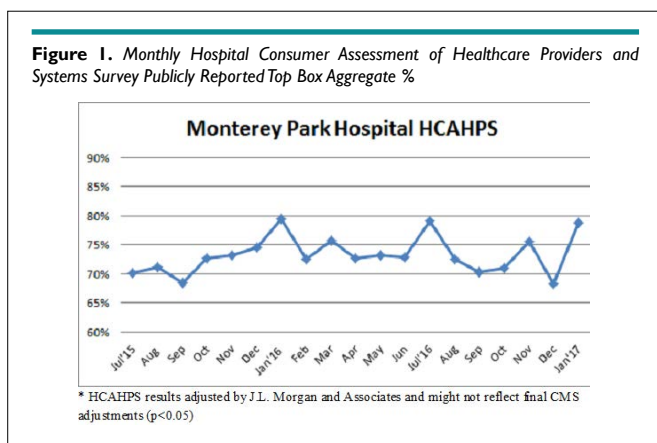mitted patients, there were a 65% reduction from 20 to 7 minutes in median door to doctor time, and a 7% decrease in total median LOS from 172 minutes to 160 minutes after the intervention. The most prominent improvement was for the discharged group, a 68% (31 to 10 minutes) and a 47% (127 to 67 minutes) were found in median door to doctor time and total LOS, respectively. All improvements were statistically significant with p-value $\leq$0.05.

Table 4. *ED Throughput Measures by Disposition*

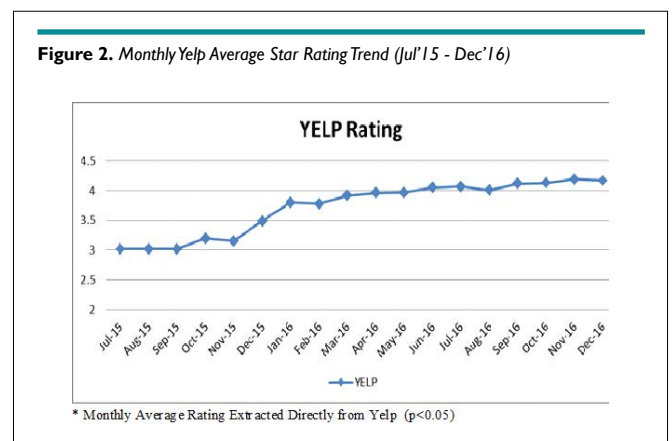|	Pre-intervention (July – Dec. 2015)	Post-intervention (July – Dec. 2016)	Differences	Differences (%)
All Disposition				
No. of Patients	3725	5379	1654	44% (*p*<0.05)
Median Door to Doctor Time	15	10	-5	-33% (*p*<0.05)
Median Length of Stay (LOS)	106	77	-29	-27% (*p*<0.05)
% of Left Without Being Seen (LWBS)	2.97%	0.39%	2.58%	-87% (*p*<0.05)
Admitted to Inpatient				
No. of Patients	412	644	232	56% (*p*<0.05)
Median Door to Doctor Time	20	7	-13	-65% (*p*<0.05)
Median LOS	172	160	-12	-7% (*p*<0.05)
Discharged Home				
No. of Patients	3252	4602	1350	41% (*p*<0.05)
Median Door to Doctor Time	31	10	-21	-68% (*p*<0.05)
Median LOS	127	67	-60	-47% (*p*<0.05)
Transferred to Other Facilities				
No. of Patients	45	62	17	37% (*p*<0.05)
Median Door to Doctor Time	18	12	-6	-33% (*p*<0.05)
Median LOS	328	282	-46	-14% (*p*<0.05)

Patient Experience

HCAHPS aggregate publicly adjusted top box % was increased by 1.11 (1.5%) from 71.67 before to 72.78 after the lean implementation. This brought the HCAHPS score above the current national benchmark of 72.72. An overall increasing monthly trend was observed from July 2015 to December, 2016 (Figure 1).

Figure 1. *Monthly Hospital Consumer Assessment of Healthcare Providers and Systems Survey Publicly Reported Top Box Aggregate %*

* HCAHPS results adjusted by J.L. Morgan and Associates and might not reflect final CMS adjustments (p<0.05)

The results of HCAHPS question AJ "During this hospital stay, were you admitted to this hospital through the Emergency Room?" were "YES" for 70.4 % of respondents for the pre-intervention period and 76% for the post-intervention period. Out of those patients who answer "Yes", The HCAHPS top box score increased from 75% (pre-intervention) to 82% (post-intervention). This is a 7% significant difference in results. The ED performance has not only positively improved HCAHPS scores but also implies higher volumes of patients are admitted through the emergency department.

MPH currently has 191 total reviews and a 4.2 average star rating on Yelp. Number of Yelp reviews doubled from July to December 2015 to July to December 2016, and the proportion of ED-related reviews also increased significantly. 9 reviews (50%) from 2015 were related to ED, and in 2016, there were 31 ED-related reviews (86%). An overall increasing trend was observed in average Yelp star rating from July 2015 to December, 2016 (Figure 2).

Figure 2. *Monthly Yelp Average Star Rating Trend (Jul'15 - Dec'16)*

* Monthly Average Rating Extracted Directly from Yelp (p<0.05)

DISCUSSION

Despite a 44% ED census increase, the study found overall improvements in median LOS, door-to-doctor time, number of LWBS patient, HCAHPS top box %, and Yelp overall rating after the intervention. The success can be attributed to a data-driven approach in project scope determination. The focus on streamlining

boarded patients was prioritized based on its potential impact on this 9-bed ED. The implemented changes have greatly facilitated ED throughput for admissions, and increased bed availability for incoming patients. A ripple effect occurred and significant reductions in total LOS, door-to-doctor times, and a reduction in % LWBS were observed. By carefully selecting a high-impact process, the ED benefited in overall performance.

In congruence with the national trends, ED patients account for a large number (80%) of total admissions at MPH (2). Over the years, the administrators have collected feedback from discharged inpatients. When asked about their overall hospital experience, a number of patients recounted only their ED stay ranging from dealing with rude doctors to extended boarding time. This provides evidence that for boarded patients, their hospital experience truly begins at ED, and their ED experience will have an influence on their HCAHPS responses. The steady increase in HCAHPS could be attributed to improvement in ED throughput, specifically the admission process, which is experienced by the majority of hospital patients.

Moreover, this study adds to the research that suggests social media sites can provide real-time patient experience feedback (5). The study found increases in the numbers of ED-related posts and average star ratings on Yelp during the performance period. While narratives from patients and family members are often subjective, these reviews often divulge key constraints to the current process for future improvements.

LIMITATIONS

This study has a few limitations. First, the current analysis excluded patients with a primary diagnosis of psychiatric conditions as defined by CMS. Due to limited capacity at most inpatient psychiatric facilities, psychiatric patients often stay in the ED for days without receiving appropriate mental health care. Furthermore, the current analysis only included data from six months prior and after the intervention and might not assess the sustainability of such intervention. Future longitudinal studies to examine the long-term impact of LEAN intervention are needed. Another limitation to be addressed is the study did not control confounding variable effects as this study was performed retrospectively.

CONCLUSION

ED crowding has placed a strain on MPH's ability to deliver quality patient-centered care. Where administrators believe that additional resources and physical space are the only solutions for ED crowding, many studies have proven that an efficient ED throughput process can effectively alleviate crowding and improve overall patient experience.[5] The current study is a part of a seven-hospital system ED improvement initiative, and MPH has made rapid improvements. The system hopes to use MPH as a model to build change infrastructure for the other hospitals. Furthermore, as healthcare moves into a patient-centered care era, social media platforms, patient experience surveys, and caregiver feedback have provided invaluable insights into patient experience that help hospitals to define patient-centered care.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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◖ ARTICLE SUMMARY ◗

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1. Why is this topic important?
a. ED crowding has placed a strain on MPH's ability to deliver quality patient-centered care. It is paramount to manage ED crowding as failure to do so have shown correlation to decreased patient safety, quality of care, and patient satisfaction.

2. What does this study attempt to show?
a. This study identifies the gaps in ED management through the implementation of ED throughput measures and how it relates to patient satisfaction.

3. What are the key findings?
a. As healthcare moves into a patient-centered care era, social media platforms, patient satisfaction surveys, and caregiver feedback have provided invaluable insights into patient experience that help hospitals to define patient-centered care.

4. How is patient care impacted?
a. Timely access to care and effective management is vital to improved outcomes. The implementation of LEAN has positively impacted ED throughput, patient experience and overall quality of care.