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Optimizing Emergency Department Throughput Using Best Practices to Improve Patient Flow

Puneet Freibott DNP, RN, NEA-BC, CCRN-K'S
The University of Texas Health Science Center Houston, puneetgf@gmail.com

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Abstract

Emergency Department (ED) crowding and bottle necks are the reality of hospitals across the country. Patients seeking care and needing inpatient beds via the emergency rooms are facing delays with attaining the right level of care. Orchestrating a patient through an ED admission requires a multidisciplinary effort to provide safe, effective and efficient care. This quality improvement project conducted in a tertiary acute care hospital focused on Centers for Medicare and Medicaid metrics to measure Emergency Department (ED) throughput. This multidisciplinary initiative focused on reducing time stamps for patient arrival to the ED through departure to hospital or home. Outcomes showed a significant decrease in the time frame for patient arrival to being seen by a qualified provider, left without being seen rates, ED diversion, and ancillary department turnaround times. The interventions can be applied at other hospital based emergency departments.

Introduction

Emergency Departments (ED) bridge the gap in care between decreased availability of primary care physicians, scheduled clinic appointments, and high rates of uninsured or underinsured patients (Schuur & Venkatesh, 2012). Overtaxing ED services has severe consequences on clinical and financial outcomes for both patients and institutions. Increased ED capacity requires increased hospital ancillary resources and inpatients beds (Institute of Medicine [IOM], 2007). Hospitals struggle with optimizing their inpatient capacity as a result of reduced number of available inpatient beds and increased lengths of stay, causing a downstream effect of patients admitted to the hospital, yet boarding in the ED for extended periods of time (Chadaga et al., 2012; Derlet & Richards, 2000; Schuur & Ventakesh, 2012).

Emergency personnel find themselves caught between a constant flow of patients entering and an uneven number of patients exiting the ED. The combined effect of fewer inpatient beds and an increase in the number of patients seeking care in EDs has caused a phenomenon known as ED crowding (American College of Emergency Physicians, 2006). Crowding reduces the ED's ability to provide high quality, efficient care and strains the resources of the ancillary departments (IOM, 2007).

A summation of current literature of factors contributing to and effects from ED crowding shows a steady increase in influx of patients needing access to care, increase in the intensity and utilization of diagnostic work ups, and decrease in the hospital's inpatient capacity. The negative downstream effects of ED crowding were increased patients that left without being evaluated (LWBS), increased ambulance diversion, and ED boarding in the hallways. The result was decreased patient safety outcomes, hospital's finances, and patient satisfaction. According to McHugh, Van Dyke, Yonek, and Moss (2012), time and expense in implementing solutions were often prohibitive to organizing change. Focused evidence-based interventions with consideration given to organizational culture, resources, and capacity could improve patient flow in the ED.

Local Problem

The hospital's ED is a non-trauma designated department with 29 treatment beds and an admission rate of 48% during 2013-2014. The hospital's ED had an inefficient throughput and output process that placed the patients at risk, as indicated by turnaround times and frequency of ED ambulance diversion. The department did not meet the national average on three major time measures: median time from door to diagnostic evaluation by a qualified professional, median time ED arrival to ED departure, and admit decision time to ED departure time.

Purpose and Aims

The quality improvement initiative was designed to improve ED throughput times, decrease diversion rates, and reduce the number of patients who leave the ED without being seen. The goal was to discover and address the inefficiencies in the ED patient flow of a tertiary acute adult care hospital in a collaborative, interdisciplinary manner, and then create a space in the EDs lobby that could be utilized to deal with ED crowding. Appendix A shows a detailed logic model for optimizing ED Throughput-ED Arrival to ED Departure and ED Arrival to Evaluation.

Ethical Considerations

Oversight by the university's institutional review board (IRB) was not required as the project was designated a quality improvement projet and the specific hospital where the project was implemented accepted the university's designation. Data collected for review and analysis were recorded and stored on a protected drive shared only by project personnel. Individual patient information was not identified.

Intervention

A project team formed from multidisciplinary stakeholders within the institution established the following evidence based interventions aimed at presenting an alternate way to deal with overcrowding in the ER as needed. The interventions were as follows:

1. Provide an evaluation area for the ED physicians to evaluate patients in the waiting room
2. Engage the ED physicians to promote the shift in culture of evaluating and treating patients in the waiting room
3. Utilize evidence based standing delegation orders in the waiting room to initiate evaluation of the patient's chief complaint
4. Provide training for ED charge nurses to fulfill the role of patient flow coordinators in the waiting room to promote communication and safety
5. Engage the ancillary departments of laboratory and radiology to reduce the turnaround times on tests and procedures.

The stakeholder team met weekly for one month prior to project implementation, and then daily for two weeks. The team convened monthly until the end of the first six months to evaluate use and success of the intervention. The team identified department and hospital wide barriers to achieving the goals and discussed ways to overcome obstacles that hindered provision of timely quality care.

Historically, ED physicians do not medically evaluate patients until they are placed in a treatment room (Pines, Pilgrim, Schneider, Siegel, & Viccellio, 2011). As in an earlier study (Dontje, K. 2007), the initiative incorporated the strategy wherein physicians could evaluate and treat patients in an alternative area when ED treatment rooms were occupied. To accomplish this, the project developed the following three approaches:

1. Obtain agreement among the physician group to evaluate patients in a private area around the waiting room to expedite treatment
2. Identify and train nurses as patient flow coordinators to improve communication, expedite evaluation, and initiate treatment of patients in the waiting room
3. Develop standing delegation orders to be utilized in the waiting room.

The patient flow coordinator also worked to decrease the number of patients who left the ED without being evaluated. The implementation of standing delegation orders was expected to decrease the time it took for physicians to make treatment decisions and provide timely evidence-based treatment. The physicians could also facilitate an earlier determination to admit or discharge a patient, and this, in turn, would decrease the overall ED arrival to ED departure time.

Emergency Room Nurse Training

As patient flow coordinators, four ED charge nurses completed a training that addressed communication tactics, documentation of patient assessment, and ways of collaborating with healthcare providers (triage nurses, charge nurses, and physicians) to prioritize patients to be evaluated in the waiting room. The flow coordinators also reviewed protocols for patient assessment and use of standing delegation orders. A main duty of the flow coordinators was to determine patient deterioration. Essentially, the flow coordinators served as patient advocates for those waiting for evaluation and treatment.

The process strategies supported changes needed to improve ED throughput. Evidence based strategies (such as formative evaluation) provided structure to modify the implementation plan in real time. As noted by Harris, Roussel, Walters, and Dearman (2011), run charts, process maps, and graphs were utilized to communicate progress and setbacks. Funding was required for construction of a private alternate consultation area and for training the patient flow coordinators.

Structural Changes

In the pre-implementation ED process, patients were triaged upon arrival to the ED, assigned an acuity level, and placed in the waiting room if there were no treatment rooms available. The treatment rooms were usually filled with patients either waiting results from diagnostic and medical provider evaluations or for an inpatient bed to become available. The implementation of a patient assessment area in the ED waiting room expedited evaluation and treatment of patients whose condition worsened as they waited to be placed in a treatment room.

To establish an ED waiting room assessement area, a hallway stretcher area was reconfigured. A treatment cart was reallocated to that area to provide supplies at hand as needed by the physicians and nursing staff. Although the arrangement was not optimal, it accommodated physicians being able to treat patients in the lobby when needed.

Methods

After project implementation, 50 charts per month (approximately 2% of 2700 plus patients registering at the ER monthly) were randomly selected and assessed using Centers for Medicare and Medicaid (CMS) guidelines for auditing core measure specifications (Centers for Medicare and Medicaid, 2014). Random collection of the data guarded against researcher bias and had the advantage of being the exact data provided to the CMS, which, as such, dictated the organization's reimbursement and ratings. Because not all charts were audited, a median number and not average data was generated. The ED throughput data was charted in minutes and as median times to permit comparison with national CMS norms. The monthly LWBS rate was determined by calculating the number of patients who checked into the ED with no follow up documentation from the nurse, physician, or registration staff. Diversion data was secured from the Regional Advisory Council that requests emergency response ambulances to be diverted to another ED. Data collected over the six month period for throughput times, diversion rates, and LWBS were analyzed using a one-tailed t-test at the .05 level of significance.

Results

The project improved throughput and a significant decrease in wait time in the ED. Significant findings were as follows:

1. Median time from door to diagnostic evaluation by a qualified professional decreased from a mean of 38 minutes to 23 minutes ($p < 0.001$)
2. ED diversion rate decreased from a mean of 32.82% to 11.5% ($p < 0.002$)
3. LWBS rate decreased from 6 per month to 3.5 per month ($p < 0.002$)
4. Radiology turnaround times improved from an average 35 minutes to 28 minutes and laboratory turnaround times improved from 67 minutes to 56 minutes ($p < 0.001$).

Although there was no statistically significant ($p > 0.05$) decrease in the median throughput time from ED arrival to ED departure for admitted patients, there was a directionally correct decrease in wait time as evidenced by 309 minutes at the end of the six-month pilot program ($p > 0.05$) as compared to a baseline average throughput time of 339 minutes.

The following figures demonstrate project improvement over the 6-month implementation period. Figure 1 shows the time between arrival at the ED and time seen.
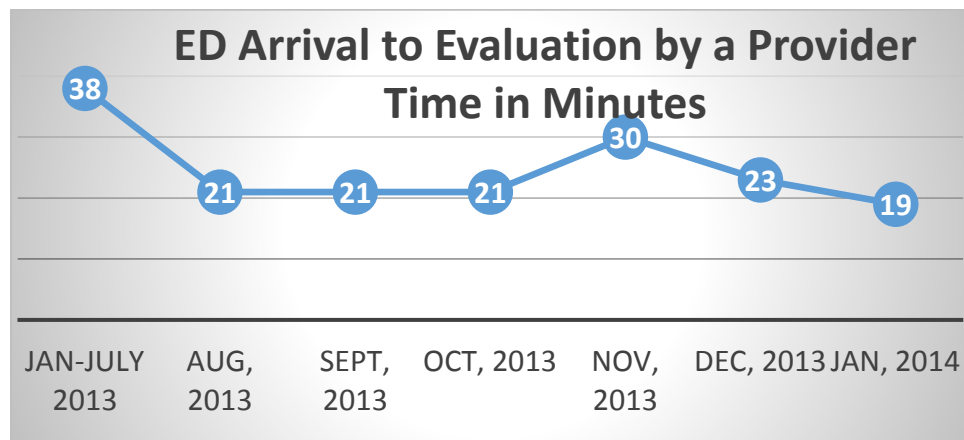

Figure 1. ED Arrival to Evaluation by a Provider
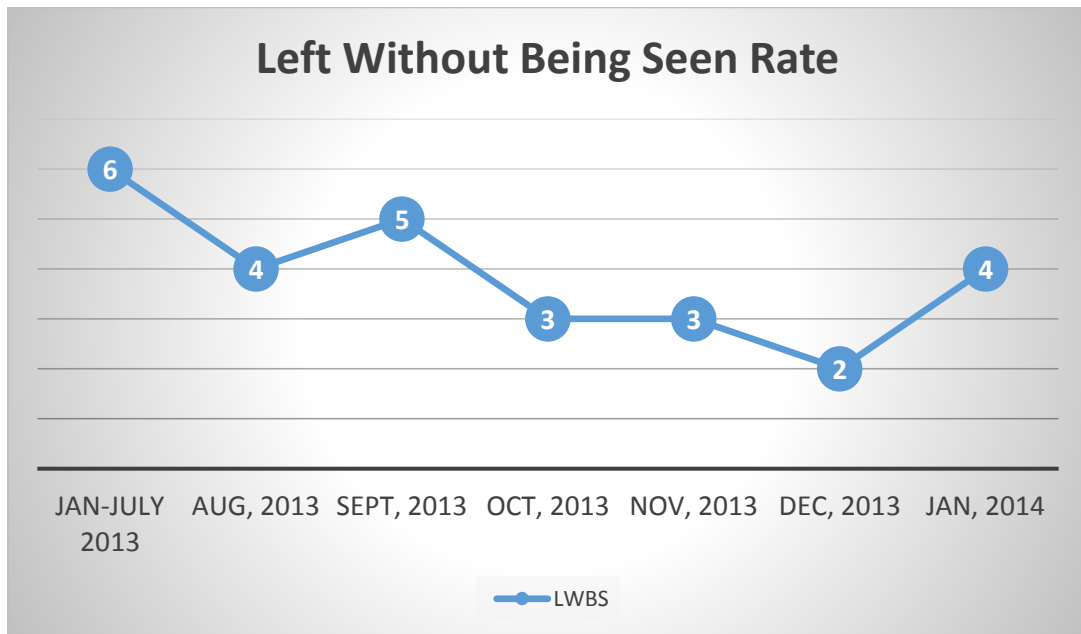
Figure 2 shows LWBS rate.

Figure 2. Left Without Being Seen Rate

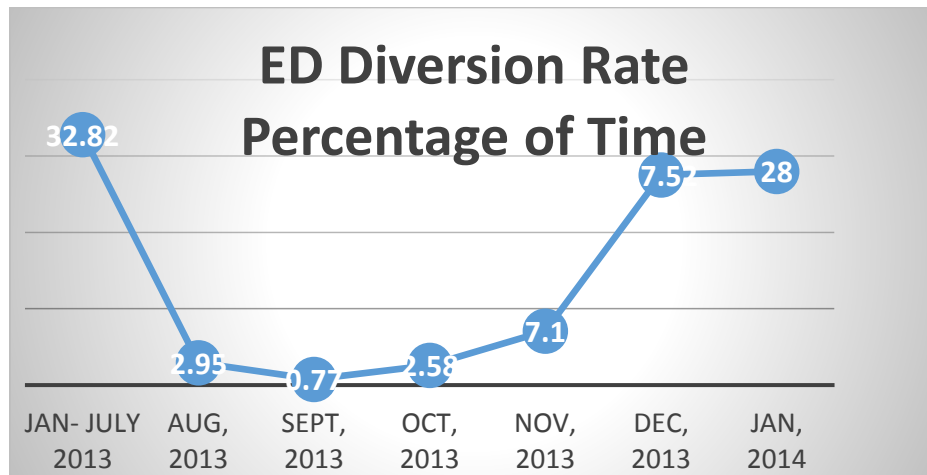Figure 3. shows ED Diversion Rate.

Figure 3. ED Diversion Rate

Figure 4 shows laboratory and radiology turn around times.
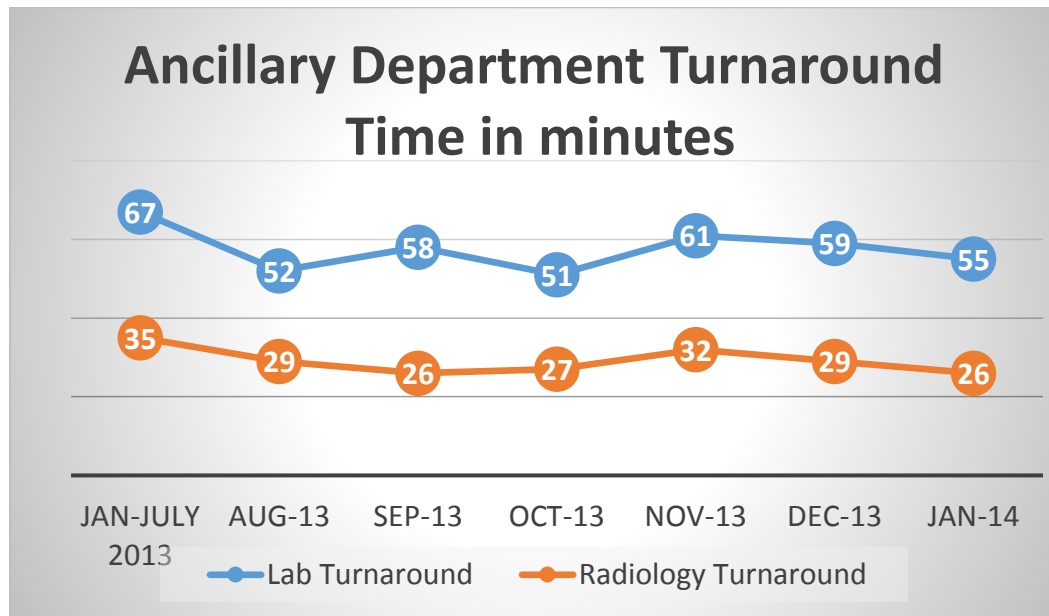

Figure 4. Ancillary Department Turnaround Time

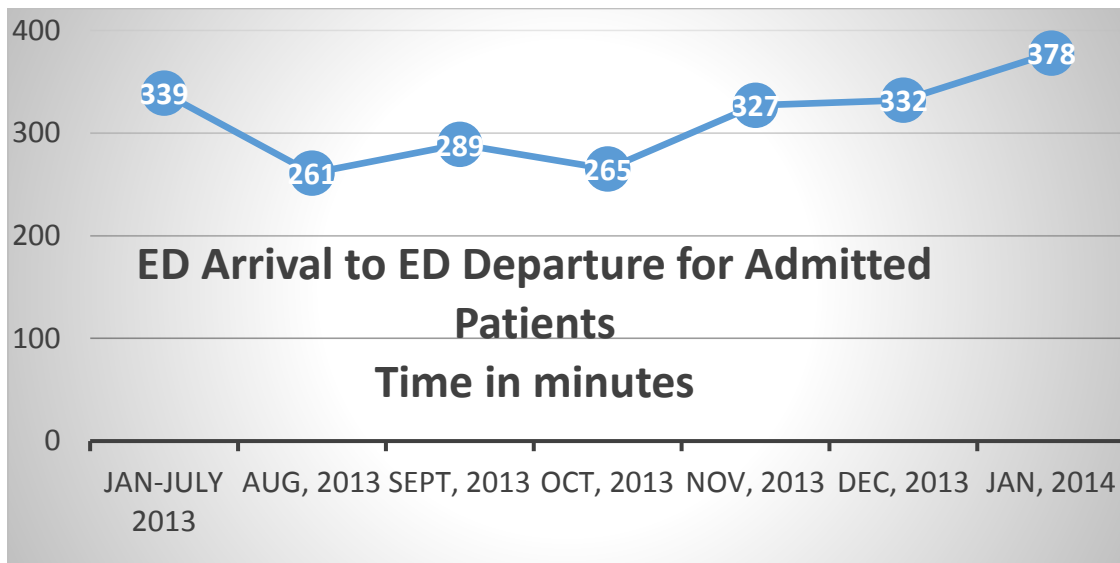Figure 5 shows time of ED Arrival to ED Departure.

Figure 5. ED Arrival to ED Departure for Admitted Patients

Individual data measures and outcomes are listed on Table 1. Detailed test results are presented in Appendix B.

Table 1: Complied Results of Outcome Measures

Metric	Pre-Data	Aug	Sept	Oct	Nov*	Dec	Jan	T-Test
Patient Volume		2467	2523	2524	2757	2591	2386	
Median time to eval In min. (Fig. 1)	38	21 s	21	21	30	23	19	P=0.0001 SD=3.89
Number LWBS (Fig. 2)	6	4	5	3	3	2	4	P=0.002 SD=1.05
ED Diversion In hrs. (Fig. 3)	32.82% 4.2	2.95% 10.9	0.77% 5.6	2.58% 39.5	7.10% 51.2	27.52% 204.9	28.0% o 208.60	P=0.002 SD=12.77
Lab Turnarond aver. In min. (Fig. 4)	67	52	58s	51s	61	59	55	P=0.001 SD=4.00
Radiology turaround a In min. (Fig. 4)	35s	29	26	27	32	29	26	P=0.001 SD=2.32
Median time to departure In min. (Fig. 5)	339	261	289	265	327	332	378	P=0.132 SD 45.82

*Influx of flu patients

Discussion

Strategy for a successful quality improvement project required a collaborative team and a detailed implementation plan. The program implementation process allowed for the stakeholders to change program details based on evaluation of ED patient flow and care, identify barriers, and generate ideas for improved patient flow patterns. The project team was successful in making changes to the practice culture of the ED physicians to include aspects such as contractual agreements, commitment to meet benchmarks, and the department's need to be competitive by meeting or exceeding national core measures.

The second core measure evaluated was median time from ED arrival to ED departure for patients admitted to an inpatient unit. The measurements reflected the efficiencies and effectiveness of the ED and the hospital throughput process. The department's incapability to move the admitted patients out of the ED in a timely manner showed in the resulting time measures, albeit improvement was seen. Inpatient processes identified as barriers to decreasing median time were telemetry utilization, discharge planning, operating room schedules, and physician pattern. The unanticipated increase in length of stay and patient volume resulted in patients waiting in the ED for their inpatient beds. It is expected that better volume projections and the ability to flex staffing when needed would alleviate the problem.

The quality improvement plan to decrease the number of patients that leave without being seen and

the ambulance diversion hours did decrease. A recommendation to the current process is to perform timely follow up phone calls to LWBS patients to provide insight from the consumer perspective of how to decrease LWBS rates in the future. The failure of patient throughput causes patients to be diverted from this ED to another ED in the city, and causing a delay of transfer to a higher level of care from ambulance to the ED. It should be noted that during the program implementation time period, an increase in flu cases overwhelmed the primary care systems pushing patients to present to the ED to help manage their illness.

The improvement in laboratory and radiology ancillary departments' efficiency positively impacted project outcomes. Historical data as compared with the department's benchmarks showed significant increase in efficiency and capacity. Efficiency in turnaround time can be a significant barrier as test and imaging results are key in the physician evaluation and treatment of patients. The direct impact of the ancillary department's turnaround times need to be evaluated in depth to achieve further improvement

The evaluation also included the interdisciplinary collaboration amongst the members of the ED throughput team. The buy-in process included team identified solutions, input from the patient flow coordinators, and nurse treatment of patients in the triage area. The process also required support from ancillary personnel for restructuring ancillary departments for speeding results to physicians.

Implications

Crowded EDs have become a worldwide phenomenon and problem and ED throughput flow impacts the quality of care provided. Streamlining processes across the ED provides efficient and effective care for patients in need of emergent care and results in increased capacity that improves access to care for patients in the community (Schuur & Venkatesh, 2012). Solutions for improved throughput affect policy that, in turn, ensure continuation and sustainment of the improvement made.

Conclusion

The QI initiative implemented to improve patient flow in the ED resulted in advantages to patient care outcomes, where such benefits included increased safety for patients presenting with emergent conditions and better outcomes for patients presenting with time sensitive indicators. The quality improvement approach to addressing throughput in a busy city ED was accomplished by a multidiscplinary collaborative team approach to examing processes of care and implementing changes that impacted patient flow and improved patient care outcomes. The team effort approach to adding a treatment area in the lobby, and streamlining patient flow problems in the ED created innovation towards a new model of care and culture in the ED and produced a spirit of collaboration and cooperation between the ED medical group, radiology, laboratory, registration, and nursing.

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Appendix A: Logic Model for Optimizing ED Throughput-ED Arrival to ED Departure and ED Arrival to Evaluation by Qualified Medical Provider

Inputs	Constraints	Activities	Outputs	Outcomes		
				Short Term	Long Term	Impact
ED throughput team: ED Staff ED Physicians Registration Staff/Administration ED Administration Nursing Supervisors Case Management	Understanding of barriers & buy-in for patient flow improvement	Provide evidence & organized informational meetings & presentations; provide goal management; provide continual feedback, facilitate on-going momentum by establishing pilot projects & sustainability	Attendance of meetings; provide valuable input, & follow up on action items in a timely manner. Run pilot programs & provide evaluations & feedback to team on ongoing basis.	Increased knowledge & buy-in for improvement from the ED throughput team.	Standard work flow processes that are based on system workflow not personnel	Increased efficiency & throughput in ED. Decrease ED arrival to ED departure for admitted patients from 339 minutes to a target goal of 204 minutes or by $p < 0.05$ significance level.
Patient Flow Coordinator in ED	Lack of established guidelines, education & training for the role.	Collaborate with staff RNs, ED management & nursing education to establish consistent role expectations & training for the patient flow coordinator	Ability to graduate from the training program & meet role expectation consistently	Implement rounding by the patient flow coordinator during established high wait times in ED	Implement rounding by the patient flow coordinator at any time when there are patients in the waiting room.	Improve left without being seen rates from average of six a month to three a month.
Evaluation by Qualified Medical Provider in ED	Lack of understanding of who can qualify to provide evaluation as the medical provider in ED. Lack of buy-in from ED MD group to provide medical evaluation at triage	Collaborate with St. Luke's legal department to establish concrete understanding of the provider role. Collaborate with the ED physician group to brainstorm innovative ways to redesign evaluation process in ED triage.	Establish & follow the hospital's rules & by-laws for qualified medical provider role. Pilot innovative process to improve evaluation time by the qualified medical provider	Perform Plan Do Study Cycles to pilot innovative processes to improve patient arrival time to qualified medical provider evaluation	Sustain processes that improve patient arrival time to qualified medical provider evaluation	Decrease door to evaluation by a qualified medical provider from 38 minutes to a target rate of less than 14 mins or at a significance level of $p < 0.05$.
Treatment area to evaluate ED patients by a physician near the waiting room	Lack of a treatment area near waiting room for ED MD to evaluate & treat patients	Enable ED MD to evaluate & treat patients while waiting in ED waiting room	A private treatment room in ED waiting room will enable physician to evaluate, treat, & discharge patients with lower acuity without occupying an ED bed.	Increased throughput time in ED for lower acuity patients	Decrease greet to provider evaluation time while positively impacting overall score from ED arrival to ED departure	Decrease door to evaluation by a qualified medical provider from 38 minutes to a target rate of less than 14 mins or at a significance level of $p < 0.05$.

Appendix B: Statistical Analysis Table

Unpaired *t* test results
Median time from door to evaluation by a qualified medical provider

P Value	0.0001
Confidence Interval 95%	11.97 to 19.03
df	10
SD	3.89
T	9.775
Standard error of difference	1.59

Unpaired *t* test results
Left Without Being Seen

P Value	0.0002
Confidence Interval 95%	1.55 to 3.45
Df	10
SD	1.05
T	5.83
Standard error of difference	0.427

Unpaired *t* test results
Diversion rate

P Value	0.002
Confidence Interval 95%	9.71 to 32.95
Df	10
SD	12.77
T	4.09
Standard error of difference	5.21

Unpaired *t* test results
Lab Turnaround Times

P Value	0.001
Confidence Interval 95%	7.36 to 14.64
Df	10
SD	4
T	6.7
Standard error of difference	1.63

Unpaired *t* test results

Radiology Turnaround Time

P Value	0.001
Confidence Interval 95%	4.73 to 8.94
Df	10
SD	2.32
T	7.22
Standard error of difference	0.94

Unpaired t test result

Median time ED arrival to ED departure for admitted patients

P Value	0.1319
Confidence Interval 95%	-10.86 to 71.53
Df	10
SD	45.82
t	1.640
Standard error of difference	18.48