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Reimagining the Delivery of Emergency Medicine

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ABSTRACT

Introduction: Emergency departments are experiencing higher volumes of patients, where overcrowding and boarding have become a normal everyday occurrence. These barriers force hospitals and specifically emergency departments to think differently when it comes to caring for patients. The old split flow model of care is no longer sufficient to move patients safely, effectively, and timely through the continuum of emergency care. This project focuses on innovating emergency department throughput and identifies new road maps to decrease the time a patient spends in the emergency department.

Methods: A multi-disciplinary team was created including nurses, physicians, patient care assistants, transporters, radiology, and patient liaisons. The team was tasked to completely reimagine a new innovative emergency care model. Go-live would be in 60 days. The challenge was to create superior emergency department throughput strategies that did not rely on the hospital having capacity. Post-implementation metrics were measured for eight months.

Results: Vast improvement was noted in nearly every emergency department metric upon go-live. Length of stay decreased by nearly 25%, left without being seen decreased to nearly 0%, left before treatment complete decreased to below 1%, and patient satisfaction more than doubled.

Conclusion: Using data analysis as the foundation for creating an innovative emergency care model was able to improve throughput inefficiencies experienced with the previous split flow model at an overcrowded urban hospital.

Contribution to Emergency Nursing Practice: This quality improvement project developed a new care delivery model for emergency departments which are experiencing overcrowding related throughput inefficiencies.

- Key implications for emergency nursing practice found in this article are that interdisciplinary collaboration is key to improving emergency department throughput.
- This article places an emphasis on utilizing data analysis to drive emergency department throughput decision making.

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Introduction

Increased daily volumes, patient acuity, Emergency Department (ED) Overcrowding, and increased ED boarder hours have created a new era of post-pandemic strains negatively impacting ED throughput [1,2]. Pre-pandemic Evidence-Based Practice (EBP) supported the split flow care delivery model to promote efficient ED throughput [3-5]. Despite past success of the ED fast-track split flow care delivery model, this model is no longer effective in navigating ED throughput barriers placed by this new era of strains on ED throughput at our hospital.

Post-pandemic demographics for our hospital showed a 24% increase in daily ED volumes. Boarder hours within our ED increased by 350% during the same two-year post-pandemic timeframe. Increased patient acuity greatly limited the number of patients eligible to receive care in a split flow care model which resulted in there frequently being more than 50 patients in our ED lobby during peak hours. Despite utilization of the EBP split flow care model by our hospital, the combination of all these new strains was a recipe for disaster and fostered an environment for negative patient outcomes in our ED and lobby [6,7].

Split Flow Model

Our ED was already utilizing the recommended vertical split flow model with a dedicated fast track and results pending care areas [3-5]. An Advanced Practice Provider (APP) was present in triage to assist with determination for patients appropriate for this vertical area [4,5]. A large percentage of our ED patients were Emergency Severity Index (ESI) level 2 chest pain and septic work ups which were not appropriate for this vertical split flow model [3,5,8]. Our 44-bed ED often was completely full of ED boarders awaiting inpatient room availability. This ED overcrowding resulted in these ESI level 2 patients being sent to the lobby after triage and an underutilized vertical space.

Lobby Overcrowding

Running an ED through the lobby has become a permanent feature

in many EDs.9 Our ED was forced to adopt ED lobby medicine as our new standard of care due to the ED always having more admitted patients than physical ED rooms. Lobby resources were expanded as our intervention to address the lobby overcrowding. Nurses were dedicated to the lobby as well as an ED tech to reassess lobby patient vitals according to the ED's standards of practice. The lobby ED tech was responsible for escalating vital changes to the lobby nurses to assist with identifying deteriorating patients within the ED lobby. Nearly all patient care was completed within the ED lobby or hallway stretchers. Most ED patients never received care in a physical ED exam room.

Triage Inefficiencies

ED overcrowding resulted in our two physical triage rooms often being filled with ED boarders. This resulted in relocating triage into two cubbies within the lobby. This space was not designed for efficient triage throughput and with increased ED volumes the triage team was always overwhelmed. Patients would experience significant delays from the time the APP entered lab orders to labs being collected due to the triage team sending the patient back to the lobby as soon as triage was completed to start the process on the numerous patients waiting in line. The lobby nurses would eventually act on the lab orders whenever time permitted.

The final intervention implemented was a quality improvement project to decrease the time from lab order to lab collection. Admitted patients were no longer allowed to board within the two triage rooms. This was non-negotiable and this space was to be protected for triage. The two triage cubbies in the lobby became overflow triage. An additional ED tech was added to the triage team with the expectation that patients do not leave triage until after all lab orders have been completed. Once the nurse and APP completed the initial triage, they would move onto the next patient while an ED tech would remain to collect all ordered labs. Once labs were completed, the ED tech would send the patient back out to the lobby and proceed to the next lab orders.

This project was effective in reducing the time from labs being ordered to labs being collected on ED patients by over 50%. However, this intervention did not improve the overall ED discharge Length of Stay (LOS) due to patients still having extensive wait times in the ED lobby after triage. Additional testing was also being ordered once the patient was eventually evaluated by a physician. Upwards of 20 patients per hour also arrive to the ED during peak volumes. Significant delays still occurred from arrival to provider during these peak volumes despite doubling the capacity of triage.

Despite multiple interventions, ED throughput inefficiencies continued due to the forementioned constraints on the department. It became apparent that the only thing that could fix the ED throughput issues was to revamp the entire current ED care model and forget everything we knew about the delivery of emergency medicine.

Method

A call to action from the executive level was made to combat the throughput deficiencies of the ED. A multi-disciplinary task force was created including nurses, physicians, ED techs, system process engineers, data analyst, transporters, radiology, and patient liaisons. This project was referred to by the multi-disciplinary team as ED 2.0 due to the team being tasked to upgrade the current ED care model version to a newer, more efficient version for the consumer. Go-live would be in 60 days, to align with the hospital's other major throughput task forces. The challenge with ED 2.0 was to create superior ED throughput strategies that did not rely on the hospital having capacity or hiring additional FTEs.

The task force met twice per week throughout the 60 day go-live timeframe. The first 30 days focused on designing a new process that will provide a meaningful patient encounter, decrease door to discharge, and improve quality and patient safety. Data analytics was the foundation for designing the new care delivery model. Data points were collected and analyzed for numerous throughput aspects such as: percentage of patients requiring labs and imaging studies, percentage of patients requiring labs or imaging studies, patients requiring neither lab or imaging studies, and patients requiring serial labs. Three distinct care phases were identified as necessary while creating a superior patient-centric ED throughput model (a) meaningful encounter, (b) treatment, (c) disposition.

Phase 1 Meaningful Encounter

While most patients appreciate the role nursing and support staff play in emergency medicine, patients ultimately come to the ED to be seen by a physician. Previously having an APP in triage was able to accomplish the goal of the split flow model with rapidly getting a provider to assess a patient, enter orders, and decrease Left Without Being Seen (LWBS) rates. This model worked well for ED throughput for the occasional low-acuity patient that was appropriate to be managed solely be an APP, but patient satisfaction survey results for these patients were still negative because the patient never was seen by a physician. However, a split-flow model with an APP is ineffective at decreasing ED LOS for high acuity patients which require physician intervention due to the physician adding more orders as evidence by the lab order to collect intervention. The new triage process also would require additional space to accommodate our increased ED volumes.

The new care model included a physician working in tandem with an APP as part of the triage team. All patients received an initial evaluation by a physician. The physician would introduce lower-acuity patients to the APP and then proceed with discussing the plan of care with the patient and the APP present. This enabled the patient to quickly receive the meaningful encounter with a physician and enabled the physician to manage up the APP to further manage lower-acuity patients. A new physician arrives on shift everything three hours between the hours of 0600 and 2100 daily. Physicians would spend their first three hours each shift in triage.

Triage was expanded to an entire small hallway within the physical ED and located next to the ED registration desk. The new triage space was able to accommodate 8 patients. An equipment alcove in the new triage hallway was repurposed with four recliners with dividers between each recliner to provide privacy. Four ED rooms with stretchers in the same hallway were utilized to finish out the new 8 triage spaces. Triage accommodating 8 patients would better manage the increased ED volumes during peak hours. A restroom was also located across from the four recliner spaces which enabled efficient urinalysis sample collection from triage. Patients would not leave triage until all labs were collected. First dose pain medications would be the only medication administered in triage. Patients requiring imaging studies would go immediately from triage to radiology.

A greeter nurse role was created who would function as the gatekeeper for the meaningful encounter. The greeter nurse was stationed with patient registration in the ED lobby. The greeter nurse would complete a quick visual assessment while patient was registering for the ED. This quick look would determine

if the patient was deemed safe to proceed with the new triage process. Patient exclusion criteria for the new triage process included but not limited to unresponsive, suspected stroke, and disabling dyspnea. If the patient was not deemed safe for the new triage process, then the greeter nurse would immediately escort the patient to a critical care bed within the ED. The greeter nurse would identify an available triage space for patients deemed appropriate for the new triage process. The greeter nurse would broadcast "Welcome new patient to triage room…" via a Vocera badge to inform the triage team of a new patient. Patients were then escorted from registration to triage by a patient liaison.

Phase 2 Treatment

Increasing the efficiency of the new triage process to include a meaningful physician encounter, lab collection, and rapid completion of imaging studies increased the number of patients appropriate for our previously underutilized results pending space. Exclusion criteria for going to results pending from triage was now (a) patients not appropriate for phase one, (b) patients identified as guaranteed admits during phase 1, (c) patients requiring cardiac monitoring, and (d) patients requiring serial labs such as troponins or lactic acids.

Results pending previously was a small hallway with 5 ED rooms directly off the old negative-airflow Covid patient lobby. These 5 rooms were equipped with recliners. With ED 2.0 vastly increasing the inclusion criteria for results pending would require additional real estate. Our ED was fortunate enough to have a large lobby. The new care delivery model would require converting 2/3 of the previous lobby into a new results pending space. This portion of the lobby would be sectioned off from the existing lobby with dividers. The new results pending space would be equipped with 16 patient recliners and space for each patient to have one visitor. The new results pending space conveniently was equipped with a restroom and located across from three patient access cubbies. Patients only requiring lab studies would go directly from triage to one of these three patient access cubbies to finish ED registration prior to going to results pending. Transportation would bring patients requiring imaging studies to patient access cubbies after competing imaging and then bring these patients to the new results pending care area.

Data analytics revealed 34% of ED patients required serial troponins or serial lactic acids. There also was an unknown number of patients presenting to the ED which required continuous cardiac monitoring. Patients previously requiring cardiac monitoring would receive care in a disorganized hallway bed location on a portable cardiac monitor. Patients requiring serial lab testing were sent back to the lobby to wait until further lab testing was scheduled for collection. Sending these higher acuity patients back to the lobby put the ED at risk of negative patient outcomes [6-7]. To mitigate these negative patient outcomes, a newly created serial lab care area was created.

The newly created serial lab location would be capable to provide care to 15 patients. The previous 5 ED rooms utilized for results pending were equipped with cardiac monitors. ED stretchers replaced the recliners to safely provide continuous cardiac monitoring for bedbound or infectious patients appropriate for this new care area. The lobby furniture was removed from the former Covid lobby and replaced with 10 patient recliners and a chair for each patient to have a visitor. The cardiac monitors previously utilized for hallway ED patients were re-allocated for use for these 10 serial lab recliner patients. Organizing these patients in a defined care area instead of disorganized hallway stretchers enabled three nurses and one ED tech to now safely care for 15 total patients instead of the same resources caring for 12 hallway patients in a disorganized and chaotic manner.

The former ED hallway beds utilized for these patients now could accommodate admitted patients boarding within the ED. Cardiac monitoring for the hallway boarders would occur through the central telemetry team via the same portable telemetry boxes used by inpatient nursing units. This additional capacity for ED boarders would now prevent admitted patients from remaining in the ED lobby for prolonged periods.

Phase 3 Disposition

Patient disposition was not a focus during each physician's three-hour triage rotation. The physician in triage focused solely on completing first provider evaluations and creating each patient's plan of care. Patient disposition was not a focus during each physician's three-hour triage rotation. If a results pending patient was ready for discussion of results and disposition, then the APP working in tandem with the physician would temporarily leave triage to complete. After leaving triage, the physician will focus on dispositions for patients in serial labs and any remaining dispositions for their patients in results pending.

The ED charge nurse was tasked with identifying a physical ED room as soon as an admission order was placed. If a physical ED room was not readily available, the ED charge nurse will find an appropriate hallway bed location to offload the admitted patient from results pending and serial labs. Moving all admissions from results pending and serials labs as quickly as possible will help the nursing team focus solely on completing patient workups and discharges.

The final 30 days focused on staff education, testing the new process, identify immediate process gaps, and project implementation. Eight different pilots were tested with each pilot lasting a minimum of four hours. Phase 1, 2, and 3 were all tested individually for dayshift and nightshift staff. The final pilot for each shift would test the entire process all together. Each pilot enabled educating the teams to the new process, solicit real time feedback, and enhance the process to ensure it worked for the front-line staff. Hundreds of pieces of feedback were obtained through the pilots resulting in multiple plans, do, study, act cycles to be completed throughout testing.

Outcomes which will be evaluated to determine the impact of ED 2.0 includes: (a) ED length of stay, (b) left without being seen (LWBS) data, (c) elopement (elope) data, (d) patient satisfaction data.1,3-7 Patient satisfaction data was obtained through third party vendor data. All other outcome data was obtained through Electronic Health Record (EHR) generated reports.

Ethical Statement

The study site is a rapidly growing 359-bed hospital which has been above maximum capacity for the last several years. The 44-bed emergency department averages 65,000 annual patient visits and often has more patients boarding in the ED than rooms in the ED. The study site has 38,000 additional annual patient visits at 3 freestanding EDs. All admissions from the freestanding EDs feed into the study site decreasing throughput at the study sites ED. No conflicts of interest were identified throughout project implementation.

Results

Despite a new record of 67 ED boarders, ED 2.0 went live on the 60th day at 0600. The positive impacts of ED 2.0 were instantaneous with a decrease in median door to discharge from

the ED on the very first day by 77 minutes despite 67 ED boarders within the department. The continued success of ED 2.0 resulted in drastic improvement of nearly every ED metric. Patient satisfaction increased by 41% after the first month of project implementation. Results will be discussed comparing the averages for eight months prior to ED 2.0 implementation compared to eight months post project implementation. Discussed averages will be displayed monthly in tables.

Prior to ED 2.0, the study site utilized an advanced practice provider in triage and a physician would later sign up for the patient when a room would become available. The study site's EMR is not able to differentiate between an advanced practice provider and physician when measuring door to provider within EMR reports. These EMR restraints resulted in the study site not being able to capture the exact effectiveness of ED 2.0 with decreasing patient's door to physician. Patients at the study site are being evaluated by a physician within 18 minutes post project implementation. Despite a 2-minute increase of door to physician compared to door to advanced practice provider prior to project implementation, the study site experienced a 53% decrease in LWBS. The study site attributes this drastic decrease despite a 2-minute increase in door to provider due to the streamlined triage process and improving the patient experience while waiting to be evaluated by a physician.

Project implementation resulted in an impressive 76% decrease in patient's leaving before treatment complete. The study site contributes this successful reduction due to decreasing door to discharge by 19% or 52 minutes through project implementation and providing patients with a new care team model based on patient's estimated ED LOS. Project implementation resulted in an overall combined 70% decrease in loss of patient opportunity. Patients greatly enjoy the improved ED throughput efficiencies offered by ED 2.0 with the study site experiencing a 72% increase in patient satisfaction after project implementation.

Improved ED throughput and drastically decreasing unmonitored lobby wait times resulted in a 35% decrease in ED intrahospital cardiac arrests despite post project implementation outcomes being measured during cold and influenza season. The study site credits the decrease in ED intrahospital cardiac arrest to improved ED throughput and patients no longer deteriorating in the lobby prior to room availability. No statistically significant difference was noted for ED out of hospital cardiac arrests. Having all patients in serial labs on a cardiac monitor also assisted with decreasing ED intrahospital cardiac arrests with a paramedic quickly identifying a patient going into ventricular tachycardia in this space within the first week of project implementation. Prior to ED 2.0, this patient would have been sitting in the ED lobby unmonitored with around 50 other patients. Due to ED 2.0, this patient's rhythm change was quickly identified, and this patient was immediately transferred to one of our critical care rooms within the ED where lifesaving interventions were quickly performed.

Combined inpatient and observation rate remained consistent pre and post project implementation at a combined rate of 33%. However, the distribution of this combined rate vastly changed due to cold and flu season being post project implementation which resulted in a 16% increase in inpatient status and a 7% decrease in patients being placed in observation status. ED throughput continued to improve despite the ED experiencing a 4% increase in daily volume, 2% increase in EMS daily volume, and 2% increase in daily ED boarder hours.

Discussion

Improving ED throughout and patient satisfaction despite continuing to experience record boarder volumes and without expanding the footprint of the ED was a daunting task. The study site believes that a large part of the success of the project was directly related to the involvement of the frontline team members with this project. The frontline ED team was informed that they did not have a choice with the need to completely redesign the entire ED care model but would have a voice throughout the entire change process. Frontline team members were involved with all aspects of ED 2.0 which resulted in team buy in due to ED 2.0 bringing the frontline team's ideas to reality. Real time feedback was obtained during each pilot from all frontline team members. The pilots were strategically scheduled to enable the ED leadership team ample time to remedy certain pain points identified by the frontline team prior to the next pilot.

After the immediate success of ED 2.0, the study site is actively working on optimizing ED 2.0 processes through construction to permanentize the serial lab and results pending spaces which were created within the ED lobby. Optimization of the serial lab space quickly started after the first month's success of ED 2.0. Construction took place in November and December which resulted in the portion of lobby space ED 2.0 designed for serial lab to be closed and these patients to be crammed into the other half of the lobby with the results pending space. Having these two care areas crammed into the space designed only for results pending caused a decrease in patient satisfaction due to limited privacy, limited visitors for these patients, and unpleasant construction noise. Despite a decrease in patient satisfaction, November and December scores were still higher than any month that year prior to ED 2.0 implementation. On December 26th, the ED team was able to move back into the newly optimized serial lab space, which was now equipped with a nursing station, Pyxis station, electrical outlets installed for each serial lab patient, and data ports at each patient location to enable data from each cardiac monitor to interface with the EMR. Reopening this newly constructed care area resulted in a drastic increase in patient satisfaction scores consistent with the same drastic increase experienced in the first month after project implementation.

The study site experienced over 70,000 ED visits in 2024 and is currently in the permitting phase of further construction to optimize the ED 2.0 processes. The study site will be permanentizing the results pending space with construction resulting in private three walled patient bays with a curtain providing privacy in the absence of a fourth wall. Each of these patient bays is designed according to the square footage required by the state's regulatory bodies. Each newly constructed patient bay will be equipped with a comfortable patient recliner, chairs for visitors, a nurse call light system, and a television. Construction will also be completed for the results pending space to be equipped with a nursing station, Pyxis station, restrooms, and hydration station for patients and visitors.

Permitting is also in the process for the study site to relocate the current main triage space to a more conducive space that will be connected to the current EMS triage area. The current main triage space is greatly separated from the EMS triage space with the study site receiving over 70 patients via EMS on peak days. Once construction is complete, the entire triage team will be able to work more efficiently as one big team instead of two separate teams. The study site anticipates a decrease in door to physician times after this construction is complete due to increased efficiencies with the physician no longer being required to walk between the two

spaces for patients arriving by different methods. The current ED layout resulting in the two triage teams being separated results in the two triage teams not being able to assist one another whenever one team is surging. The study site anticipates that combing the two triage teams will results in improved efficiency of the triage team and improved patient throughput in triage.

The study site is part of a healthcare system with multiple hospitals in the greater metropolitan area. Multiple EDs within the health system have recently visited the study site to obtain information to visualize the processes of ED 2.0. The study site has shared all aspects of creating, educating, and sustaining ED 2.0 with these ED leadership teams so that each ED leadership team can utilize ED 2.0 as a foundation for project implementation at each specific ED within the system. All aspects of ED 2.0 are not required for each ED within the hospital system as the study site has the largest service line volume, highest intubation volume, highest EMS volumes, highest psychiatric volume, and highest boarder volumes. Each ED within the system which utilized ED 2.0 as the foundation of their ED redesign has additionally experienced positive improvements in nearly all ED throughput measures.

There is a notable limitation to this study. The study site is classified in Vizient's large, specialized complex care medical center cohort. The health system is mimicking the study site's ED 2.0 redesign with similar results at their EDs within the comprehensive academic medical center and complex care medical center cohorts. Thus, the results from this study may not be generalized to the community hospital cohort. Further research would be required to identify if implementation of ED 2.0 would be effective at the community hospital cohorts due to community hospitals experiencing different barriers than large medical center hospitals.

Implications for Emergency Nursing Practice

Whenever implementation of evidence based best practices does not achieve desired results, a call to action involving innovative solutions is required. The study site was effective in creating an entirely new ED care delivery model which could safely accommodate higher-acuity vertical patients to improve nearly all ED throughput metrics and patient satisfaction. Improvement continues despite a 10% increase in patient volume from project conception to now.

Conclusions

Creating an entirely new ED care delivery model within 60 days would appear as an impossible task to most organizations. However, everything is possible whenever an organization fosters a culture of innovation and excellence through empowering the frontline team members to have a voice in process improvement. Frontline team involvement with ED 2.0 redesign brainstorming sessions, thorough pilots involving all shifts within the ED, and with leadership support, the ED frontline team had the tenacity, drive, and mindset that failure was not an option for ED 2.0.

Conflicts of Interest

The authors have not identified any conflict of interest throughout pre-implementation data collection, project implementation, or manuscript preparation

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