

2016

Improving waiting times in the Emergency Department

<https://hdl.handle.net/2144/19424>

Downloaded from DSpace Repository, DSpace Institution's institutional repository

BOSTON UNIVERSITY
SCHOOL OF MEDICINE

Thesis

IMPROVING WAITING TIMES IN THE EMERGENCY DEPARTMENT

by

JOSHUA MEDEIROS

B.S., Salve Regina University, 2007

Submitted in partial fulfillment of the
requirements for the degree of

Master of Science

2016

© 2016 by
JOSHUA MEDEIROS
All rights reserved

Approved by

First Reader

Jolion McGreevy, M.D., M.B.E., M.P.H.
Assistant Residency Director, Director of Undergrad. Medical Education
Department of Emergency Medicine
Boston Medical Center
Instructor of Emergency Medicine

Second Reader

Oren Berkowitz, Ph.D, MSPH, PA-C.
Director of Research
Assistant Professor of Medicine

ACKNOWLEDGMENTS

I would like to thank my thesis advisor, Dr. Jolion McGreevy, for all his help throughout this process. Also, I thank my fellow classmates, friends, and family for their help and support.

IMPROVING WAITING TIMES IN THE EMERGENCY DEPARTMENT

JOSHUA MEDEIROS

ABSTRACT

Waiting times in the Emergency Department cause considerable delays in care and in patient satisfaction. There are many moving parts to the ED visit with multiple providers delivering care for a single patient. Factors that have been shown to delay care in the ED have been broken down into input factors such as triaging, throughput factors during the visit, and output factors, which include discharge planning and available inpatient beds for admitted patients. Research has shown that throughput factors are an area of interest to decrease time spent in the ED that will lead to decrease waiting room times. In this Quality Improvement project, we will develop a systematic check in system with ED providers that will allow providers to identify any outstanding issues that may be delaying care or discharge. We hypothesize that this system will increase throughput in the ED by resolving any lab, radiology, or treatments that were overlooked. Reviewing the results of this QI project will allow us to see if we were effective in our timing of scheduled check-ins. Ultimately, this will reduce time spent in the waiting room by allowing more patients to be seen. In the era of the Affordable Care Act, more patients have access to affordable healthcare and will increase volume in the ED. This check-in system will allow more patients to be seen smoothly and in a timely manner that will improve and increase patient care and satisfaction in the ED.

TABLE OF CONTENTS

TITLE.....	i
COPYRIGHT PAGE.....	ii
READER APPROVAL PAGE.....	iii
ACKNOWLEDGMENTS	iv
ABSTRACT.....	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS.....	x
INTRODUCTION	1
Background.....	1
Statement of the Problem.....	1
Hypothesis.....	2
Objectives and Specific Aims.....	3
REVIEW OF THE LITERATURE	4
Overview.....	4
Existing Research.....	11
METHODS	19

Study Design.....	19
Study Population and Sampling.....	19
Inclusion/Exclusion Criteria	19
Intervention.....	20
Plan	20
Findings of Chart Review	21
Study variables and measures	21
Recruitment.....	22
Do.....	22
Study and Analysis	23
Act.....	23
Timeline and Resources.....	23
Institutional Review Board	24
CONCLUSION.....	25
Discussion.....	25
Summary.....	25
Clinical and Public Health Significance	27
LIST OF JOURNAL ABBREVIATIONS.....	28
REFERENCES	29
CURRICULUM VITAE.....	32

LIST OF TABLES

Table	Title	Page
1	ED Overcrowding: Where Do the Problems and Opportunities Lie	5
2	Goals and Features of Redesigned HER Systems to Support ED Diagnosis and Workflow	16
3	Inclusion and Exclusion Criteria	19
4	Timeline of Initial Study	23

LIST OF FIGURES

Figure	Title	Page
1	Standard ED Timestamps and Intervals	11
2	Patient Metrics	14

LIST OF ABBREVIATIONS

BMC.....	Boston Medical Center
BU.....	Boston University
ED.....	Emergency Department
EDPEC.....	Emergency Department Patient Experiences with Care
EMR.....	Electronic Medical Record
ESI.....	Emergency Severity Index
HCAHPS.....	Hospital Consumer Assessment of Healthcare Providers and Systems
IOM.....	Institute of Medicine
LOS.....	Length of Stay
PIH.....	Protected Health Information
POCT.....	Point-of-Care Testing
QI.....	Quality Improvement
RFID.....	Radiofrequency Identification

INTRODUCTION

Background

Improving waiting times in the Emergency Department (ED) is a topic of heavy interest. Care and patient satisfaction have been adversely affected by increasing time spent in the ED. We propose that performing hourly check-ins on patients being treated will decrease length of stay by making the provider aware of any hold-ups hindering care and throughput. This will trickle down and cause reduced waiting times for patients in the waiting room.

Statement of the Problem

Increased wait time and length of stay (LOS) in the emergency department have been shown to reduce quality of care and increase incidences of adverse events.¹ Reducing wait time has become a nation wide priority. Various studies have shown that most hospitals are not meeting wait time and throughput benchmark of 90% of patients being seen per hour.¹ Emergency Department overcrowding is directly related to the total length of stay and boarding of admitted patients. Expediting the disposition of patients should reduce their ED total length of stay.² Studies examining where the most waiting time occurs have separated a patient's visit in the ED into time spent 1) in triage, 2) in the treatment room, and 3) waiting for discharge.³ The issues during treatment that may cause backups include patient flow, laboratory and radiology turn-around time, order input, and admitting or discharging of patients. Since the trend of ED volumes is

increasing each year, the need for efficient service is intensifying.³ Preventing a lag in any of these areas will improve not only wait times, but also patient care and satisfaction.

Thompson et al⁴ found that “perceptions regarding waiting time, information delivery, and expressive quality predict overall patient satisfaction, but actual waiting times do not. Providing information, projecting expressive quality, and managing waiting time perceptions and expectations may be a more effective strategy to achieve improved patient satisfaction in the ED than decreasing actual waiting time.”⁴ However, recent studies have shown that waiting time does, in fact, directly affect patient satisfaction.⁵

A study by McCarthy et al⁶ analyzed patient-provider conversations and found, patients could spend as little as 25% of the visit interacting with care providers. The authors believe that in room waiting time “represents uncharted territory for possible innovative interventions.”⁶

Hypothesis

Hourly check-ins on patients being treated in the Emergency Department will improve waiting times during several stages of ED visits by expediting patient care and disposition from the ED. These check-ins will identify causes of delayed care and disposition – and provide ED staff with specific interventions to expedite care and improve patient satisfaction.

Objectives and Specific Aims

A chart review will be performed to determine if and how check-ins are being done currently. EPIC offers a template for providers to document progress notes when they have “checked-in” on a patient. Anecdotally, this seems to be more utilized by nursing staff, as residents and attendings tend to check in with a patient less frequently.

Reviewing this specific information in EPIC will allow us to see how often check-ins occur, who performs them, and what actions are being carried out.

Items that could be discussed during check-in include radiology results, laboratory results, and discharge paperwork. This creates an opportunity to evaluate if the services being done at these times are beneficial to the patient’s experience and length of stay. Interventions executed but not reported could cause repetition of services or missed opportunities to further the patient’s care.

We will meet with the stakeholders who will be performing the check-ins and providing care (nurses, residents, volunteers) to allow us to develop a system that can be incorporated into the daily ED routine in a way that does not disrupt work flow or care.

- Check-ins will decrease waiting times for services and treatment
- Check-ins will also increase patient satisfaction of care

REVIEW OF THE LITERATURE

Overview

The Hospital Emergency Department has become a “highly effective setting for urgent and lifesaving care, as well as a core provider for ambulatory care in many communities.”⁷ However, the Institute of Medicine has stated that a national crisis is occurring due to the overwhelming demands placed on the ED system throughout the country.⁷ Overcrowding in the Emergency Department has been a national issue for the past 10-20 years.⁸ Increased waiting times for patients has led to less timely care and lower patient satisfaction while negatively effects on complication rates, and mortality.⁹ Time magazine discussed this in a cover story in 1990¹⁰ and, in response, many hospitals enlarged EDs, increased staff, and residency programs in emergency medicine increased 80%. Unfortunately, these modifications have been unable to keep up with demand.⁸ Previous belief held that overuse of the ED occurred due to uninsured patients, but recent literature by Schiff¹¹ has proven these claims to be prejudiced and scientifically inaccurate. Furthermore, research found that people with insurance coverage use the ED more than the uninsured.¹²

Factors that have been known to cause overcrowding have been categorized into three general concepts: input, throughput, and output factors.¹³ Hoot and Aronsky¹³ define input factors as those that reflect resources and patient flow including non-urgent visits, frequent flyers patients, and influenza season. Throughput is defined as bottlenecks in the ED¹³, including inadequate staffing, and output factors that occur in other aspects of healthcare, such as inpatient boarding and hospital bed shortages. Factors not classified

into those three broad categories include, increasing patient volume and acuity, shortage of treatment areas, shortages of nursing staff, delays in ancillary services, boarding inpatients, and hospital bed shortages.¹³ However, these could be best classified as throughput issues. All of these issues have caused physician productivity and efficiency to decrease.⁸ Schiff,¹¹ presented these issues in Table 1.

Table 1. ED Overcrowding: Where Do the Problems and Opportunities to Improve Lie¹¹

		Min	Max
Upstream	18		
No PCP	4	1	10
Lack after-hours access from usual source care	3	1	6
Could be safely handled nonemergency by PCP	4	1	8
Inappropriate patient utilization choices	1	0	2
Chronic mental illness, substance abuse, homelessness	4	2	9
Seasonal/surge demands	2	1	4
Intra-ED Flow	20		
Increased volume numbers patients	2	1	3
Inadequate space for demand/census	2	1	4
Insufficient staffing for volume/peaks	2	1	5
Throughput efficiencies for radiology	2	0	5
Throughput efficiencies for lab tests	2	0	5
Clinical documentation, other EMR inefficiencies	1	0	3
Language barrier interpreter services delays	1	0	2
Delays related to specialist/consultations	2	1	6
Observation unit issues: space, staff, policies	1	0	2
Other/general workflow inefficiencies	4	1	7
Downstream	63		
Inpatient bed unavailability for required admissions	35	19	58
Lack mechanisms for "safe" follow-up checking (nurses phoning)	7	3	12
Lack mechanisms for "safe" early discharge pending labs	4	3	5
PCP not readily available to "pull" for follow-up	10	2	15
Social service resources, discharge option	7	2	13
All values reported are percentages. EMR = electronic medical record; PCP = primary care physician. *Focus group/poll of 10 selected EPs in U.S. in Canada.			

A large portion of the population is aging and living longer with chronic disease, such as congestive heart failure, chronic obstructive pulmonary disease, renal failure, and AIDS. These patients typically present with complications that may exacerbate and cause increased ED visits.⁸ Patients suffering from multiple comorbidities complicates this issue.⁸ Previous studies have shown that these patients will not increase the number of visits, but increase length of stay.¹²

Derlet and Richards⁸ describe the lack of beds for admitted patients, intensive therapy in the ED, delays due to laboratory and ancillary services, shortage of nursing staff, shortage of administration and clerical support staff, shortage of on-call consultants or lack of availability, shortage of physical space in the ED, problems with language and cultural barriers, shortage of house staff rotating through ED, increased medical record documentation requirements, and difficulty arranging follow-up care as additional problems that have caused overcrowding.⁸ However, fixing input and output factors, such as lack of inpatient bed and arranging follow up care, are generally out of the control of the ED, and “many EDs have worked on throughput efficiencies for improving their processes for assessing, testing, and readying patients for discharge.”¹¹

Derlet and Richards⁸ discussed patients who previously required inpatient admission, but are being now effectively being treated in the ED. Improvements in technology, new pharmacologic agents, advances in medical science, heightened standards of practice, and residency training of emergency physicians have influenced this change. Examples include: asthmatic patients who are now treated and observed in the ED, trauma patients who are stable after workup in the ED and can be discharged, psychiatry patients who currently wait in the ED before transfer to a psychiatric facility, new protocols for treating patients with chest pain, and patients with infections being treated with intravenous antibiotics in the ED who are observed and then discharged home.⁸ These interventions have increased the patient’s time in the ED, which has exacerbated the problem of overcrowding and increased LOS.

Nursing staff shortage has also been implicated in overcrowding of the ED. This is due to a lack of experienced and dedicated nursing staff and a large turnover of staff being replaced by non-experienced staff. Float nurses who are not familiar with the ED and may not be as efficient in care are also an issue.⁸ A shortage of clerical staff can also worsen an already overcrowded ED since the ED relies on a substantial volume of clerical work such as telecommunications, laboratory and radiology requisitions, and processing of admissions/discharges.⁸

Another shortage that contributes to increasing waiting times is lack or unavailability of on-call specialty consultants such as neurology and surgery. Consultation is needed in order to provide definitive treatment and to facilitate admission of patients. Consultants are overwhelmed with inpatient and clinical responsibilities in larger, busier hospitals. Smaller hospitals have fewer consultants available, resulting in transferred care to a larger ED causing more crowding.⁸

ED size has been implicated as a cause for overcrowding. However, as EDs become larger to facilitate an increase of patients, more patients utilize the ED.⁸ A study by Sayah et al¹⁴ showed this very phenomenon in the expansion of an ED in the Cambridge Health Alliance Whidden. Expansion alone did not improve throughput, but resulted in operational changes that did show improvements.¹⁴ These changes resulted in the patient being able to stay in the same room and be cared for by the same clinical team, which reduced the total time of stay by minimizing patient moving, team handoffs, and the likelihood that fewer miscommunications and errors will occur.¹⁴

An increased need for the use of translators may be needed in areas with a large number of non-English speaking patients. Demand for a translator increases time as clinicians and other staff need to wait for the translator and set aside additional time for translation.⁸

Teaching hospitals experience a disproportionately larger number of ED visits compared to other centers.⁸ The use of house staff is important at these centers, but they are less likely to rotate through the ED.⁸ There were two studies that explored the use of medical students and residents in the ED. It was determined that the use of a medical student did not effect LOS, but use of residents increased throughput by an average of seven to 39 minutes.¹⁵ Adding physicians in triage reduced LOS by 18%; however, it was reported that the significant cost of doing that outweighed the benefits.¹⁵ Zun concluded that “keys to success were a rapid turn redesign process . . . and having managers focus on a self-initiated process improvement methodology.”¹⁵

Kocher et al¹⁶ found the most common screenings to be blood tests and radiographic studies. They discovered admitted patients had one or both tests done more often than patients discharged from the ED. These integral parts of the ED evaluation reveal an area for improvement. Studies show that incorporating more point-of-care testing lowers LOS¹⁷ by an average of 54 minutes.¹⁵ One way this has been investigated was a study by Singer et al¹⁷ that compared troponin levels being tested by the central laboratory or by POCT by nursing staff. It was found that using POCT decreased LOS by an average of 1.9 hours¹⁷ and has now been implemented in the ED where it was investigated.

The effects of overcrowding, due to increased length of stay, have caused many issues including an increase in the safety risk to the public. Some patients are not being seen in a timely manner as providers are seeing more complex patients and performing non-physician tasks.⁸ Examples included in a study by Derlet and Richards⁸ are a patient with hyperthermia who did not have her temperature taken at triage due to nursing staff being too busy, a patient with a subdural hematoma that sat in the hallway for eight hours because the staff was too busy to evaluate, and a patient with an undiagnosed myocardial infarction that did not get assessed for two hours causing significant delay in thrombolytic administration. These cases show how delay in assessment and treatment prolong patient safety, pain, and suffering.

Long waits and patient dissatisfaction have become major issues reflected in the number of patients leaving without being seen. This creates the possibility for minor medical problems to turn into more serious issues.⁸ Overcrowding also causes ambulance diversions that increase transportation times, risk of an accident during transport, and potential poor outcomes.⁸ Physician productivity decreases as overcrowding and waiting times increase. Physicians become stretched thin and this compromises patient care.⁸

Additionally, negative effects on medical student training have been seen. Derlet and Richards state that medical education has evolved to bedside teaching, but with the increased demands on physicians, it is too busy in the ED to teach.⁸

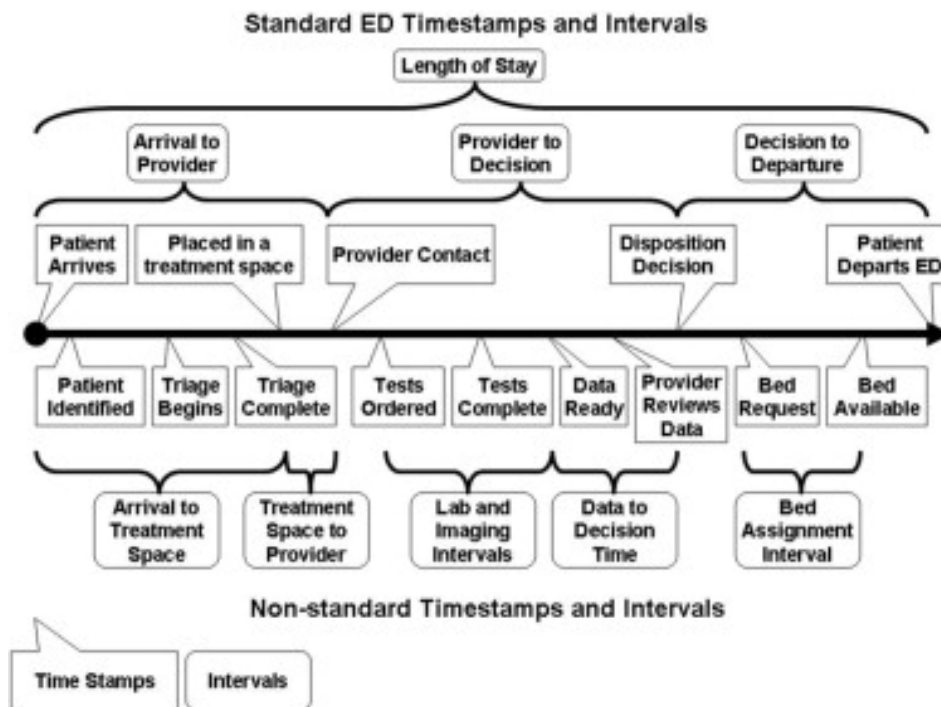
There is a need for “high communication loads”⁵ in the emergency department and breakdowns occur when the ED is overwhelmed.⁸ A study by Fairbanks et al⁵ it was shown that physicians communicate with other attending physicians the most, possibly to

get a second opinions of difficult cases. This can be lost when a breakdown in communication occurs, affecting patient outcomes. Other forms of communication such as lab requisitions can also be mislabeled during busier times causing incorrect lab results and need for retesting.⁸

Understanding the flow of a patient through the ED is necessary in developing a new process to combat throughput issues. A study done by Welch et al¹⁸ attempted to define standardized time stamps and definitions of the flow through the ED. They identified three main intervals that occur during the length of stay including; arrival to provider, provider to decision, and decision to departure.¹⁸ Within these intervals were many different potential timestamps. These are displayed in figure 1.

Throughput determinants were studied in a literature review by Zun,¹⁵ and five broad categories were determined. One was throughput determinants such as increased admissions, number of ambulance arrivals, number of pediatric patients, and ED census.¹⁵ A paper by Eitel et al¹⁹ analyzed throughput and capacity and found a large percentage of waiting time spent in the room without being seen by a provider.

Figure 1. Standard ED Timestamps and Intervals¹⁸



Existing Research

Multiple studies have been done to reduce LOS in the ED. Pines and Bernstein²⁰ believe the best method is based on three approaches based on the demand supply theory: reduce care demands, increase resources, or better match supply and demand. Ways that have been explored to reduce care demands have included adding physicians to triage, bypassing triage altogether in favor of immediate bedding, and reducing intensity of care by using clinical decision rules.²⁰ Adding physicians did help reduce LOS by 18%, but the significant cost may outweigh the benefits.¹⁵ By bypassing the registration triage system that was initially in place, the patient was instantly triaged, which decreased the potential risk of patients. Overall LOS decreased by 30%.²¹

Ways to increase resources in the ED include adding additional staff and locating staff and equipment more efficiently. However, additional staff and extending weekly work hours of staff can be costly, and may not decrease length of stay.²⁰ There can be supply/demand mismatches since the ED is usually staffed based on an average day. Pines and Bernstein²⁰ propose increasing resources when needed during times of crowding. An example is an ED design that moves the waiting room from an external location to inside the ED.²⁰ This way on-critical patients can sit in a chair, be treated, and wait for tests to be performed occupying a room.²⁰ A study by Handel et al³ at Albert Einstein Medical Center in Philadelphia found time spent searching for personnel, patients, and equipment was affecting timely care in the ED. They started using radiofrequency identification (RFID) technology in personnel badges, patient identification badges, and on equipment. RFID was tracked using sensors located throughout the ED. This enabled the charge nurse to quickly identify personnel and patient location, available rooms, and required equipment. This provided a more accurate patient flow map, reduced ED LOS from 9 hours to 3.5 hours over six years, reduced number of patients leaving without being seen from 5% to 0.5% over 5 years, and provided an 89% reduction in ambulance diversion, increased patient satisfaction from 15% to 20%, and improved core measures in compliance.³

In an attempt to better match supply and demand, Spaite et al²² studied an ED that had done a rapid process redesign with a 76 minute reduction in the average patient's LOS. The factors they focused on included staffing and internal processes, triage and registration procedures, and diagnostic radiology, laboratory, and bed availabilities. The

study found that in order to have such large decreases in LOS time that all aspects of intradepartmental and interdepartmental functioning needed to be improved along with the full support of the administration and emergency physician staff.²²

Pines and Bernstein²⁰ concluded that these issues are complicated, time-consuming, and require considerable staff time, effort, and investment in order to change culture and process. Strong, effective leadership and management were urged by Dr. Randy Pilgrim, MD at the *Academic Emergency Medicine* consensus conference in Boston, Massachusetts in 2011.²³ Sayah et al² stated that during times of change, confusion among staff and unclear leadership is a recipe for failure. They included all stakeholders with a well-developed mission including physician, nursing, administrative, and ED leadership. They improved inefficiencies through strategy rather than heavy capital investment.²

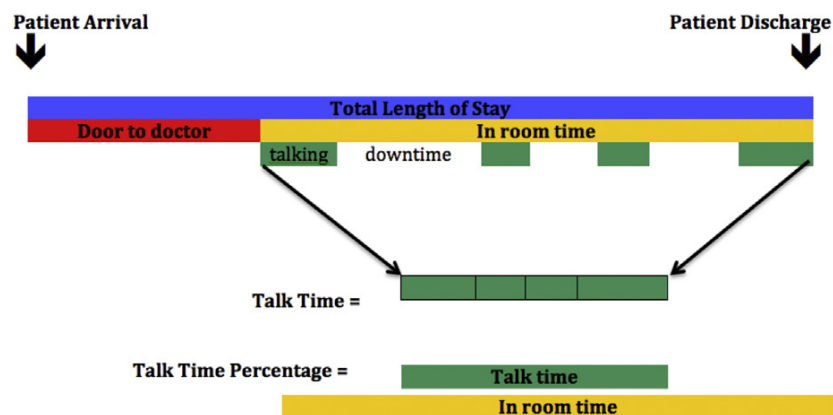
Patel et al²⁴ designed a process improvement plan with the ED and hospital leaders that worked toward admit wait time reduction. In the study, overall admit wait time was split into two intervals 1) from time request for admit was made to time the hospital ward accepted the patient and 2) from time the hospital ward accepted the patient to time the patient left the ED. The goal was to make each time interval span 30 minutes and that interval 1 is the responsibility of the hospital staff and interval 2 is the responsibility of the ED staff. Top leadership reviewed this information frequently and often made direct contact with their staff in real times if delays were observed in either of the two interval segments, allowing for immediate resolution of issues causing delays.²⁴ This study was able to significantly increase the number of patients admitted to the

hospital within 60 minutes. Other results included decreased LOS, reduced number of patients leaving without being seen, reduced ambulance diversions, and improved patient satisfaction.²⁴ The support of ED leadership and hospital leadership were seen as effective strategies to implement this change.

However, in a literature review performed by Zun¹⁵ there was no consensus on which techniques could improve ED efficiency and decrease LOS. This is likely due to differences between teaching and non-teaching, small community versus large university, trauma versus non-trauma, and large versus small volume hospitals though it is unclear.¹⁵

A promising direction explored by McCarthy et al⁶ involves looking into the duration of patient-provider conversations during an ED visit. Patient conversations were analyzed to determine the amount of patient interaction with clinicians after being placed in a room and what proportion of the in-room visit was spent waiting.⁶ The findings are shown in figure 2.⁶

Figure 2. Patient Metrics⁶



This study was limited due to provider conversations being recorded and not separated by speaker type and McCarthy et al⁶ were analyzing time and not value of the conversation. They believe that the patient may value conversation more with an attending than with a technician. Another limitation is that patients in the study were likely to have a diagnosis that could be seen in an urgent care setting and were all discharged, not admitted to the inpatient setting.⁶ Additional endpoints such as patient satisfaction, knowledge, and medical outcomes were not studied. A correlation between waiting time in the room and impact in clinical care cannot be determined.⁶ However, Thompson et al⁴ found that managing waiting time perceptions and expectations may be a more effective strategy. Room exists to explore how the waiting times in room affects how patients perceive the in-room waiting times and how patient satisfaction is affected. The waiting times also “represent uncharted territory for possible innovative interventions.”⁶

In-room waiting time can be used for providers to perform check-ins. This provider check in can tie many different loose ends together. The provider can help manage complexity and acuity of changes by monitoring the patient’s status. They can also follow-up on delays in laboratory and other ancillary services, especially at busier times in the ED when a patient alone in a treatment room could be overlooked.

This could be implemented by tying more frequent check-ins within the EMR system. Providers are currently entering ED Notes into the EMR. Providers interacting with the patient and following up with any outstanding issues can be considered check-ins. Schiff¹ describes using better EMRs and clinical documentation as being critical to

support diagnosis and workflow. Table 2 describes how EMRs can be redesigned to support such a model. However, Harle et al²⁵ concluded that to implement a new process into the EMR successfully, the clinical benefit must be known and should minimize time, work, and flow disruptions. Interface use should be easy, patient related outcomes automated, and only relay patient related outcomes relevant to the type of visit. Policy makers and clinical leadership need to be heavily involved for EMR change to be effective.²⁵

Table 2. Goals and Features of Redesigned EHR Systems to Support ED

Diagnosis and Workflow¹¹

Role for Electronic Documentation	Goals and Features
Providing access to information	Ensure ease, speed, selectivity, filtering information searches; to aid cognition through aggregation, trending, contextual relevance, and minimizing of superfluous data.
Recording and sharing assessments	Provide a space for recording thoughtful, succinct assessments, differential diagnoses, contingencies, unanswered questions; facilitate sharing and review of assessments by both patient and other clinicians.
Maintaining dynamic patient history	Carry forward information for recall, avoiding repetitive patient querying and recording while minimizing erroneous copying and pasting.
Integrating/maintaining problem lists	Ensure that problem lists are integrated into workflow and facilitate continuous updating.
Tracking medications	Record of medications patient actually taking, patient responses to medications and adverse effects to avert misdiagnoses and ensure timely recognition of medication problems.
Tracking tests	Integrate management of diagnostic test results into workflow to facilitate appropriate ordering, review, assessment, action, handoffs, and documentation.
Ensuring coordination and reliable handoffs	Aggregate/integrate data from acute and chronic care episode encounters into quick snapshot/synthesis from prior, to subsequent providers.
Safety need for patient follow-up	Facilitate patient education about potential red-flag symptoms to watch for; track follow-up.
Providing feedback	Automatic provision of feedback to upstream clinicians (including recent EP from recent visits), facilitating learning from outcomes of diagnostic decisions.
Providing prompts	Provide checklists to minimize reliance on memory and directed questioning to aid in diagnostic thoroughness and problem solving.
Buffering interruptions providing placeholder for resumption of work	Delineate clearly in the record where clinician should resume work after interruption, preventing lapses in data collection and thought process.
Calculating Bayesian probabilities	Embed calculator into notes to reduce errors and minimize biases in subjective estimation of diagnostic probabilities.
Providing access to information sources	Provide instant access to knowledge resources through context-specific “infobuttons” triggered by keywords in notes that link user to relevant textbooks and guidelines.
Real-time consultations	Integrate immediate online or telephone access to consultants to answer questions related to referral triage, testing strategies, or definitive diagnostic assessments.
Increasing efficiency	The holy grail. Can more thoughtful design, workflow integration, easing and distribution of documentation burden speed up charting, workflow, thereby freeing time for communication and cognition?

A need exists for better tools to evaluate patient satisfaction in the ED. The first

“national, standardized, publicly reported survey of patients’ perspectives of hospital

care” was the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey developed in 2006 by the Centers for Medicare & Medicaid Services and the Agency for Healthcare Research and Quality and endorsed by the National Quality Forum.²⁶ This survey consists of a 32-item questionnaire categorized into 8 general composites administered to adult patients 48 hours to 6 weeks after hospital discharge. Questions about ED admission were added in 2013, but developers recognized that survey tools should be developed for the ED use.²⁶

In 2012, the Centers for Medicare & Medicaid Services developed the Emergency Department Patient Experiences with Care (EDPEC) Survey to address patient care received in the ED.²⁷ There are three versions of this survey being developed due to the different outcomes of an ED visit. There will be one version intended for patients discharged home for the ED, another for patients admitted to the hospital, and a third version to supplement the existing Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey.²⁷ These surveys will address a patient’s experiences arriving to the ED, the care provided, and the outcome of ED care. These surveys could potentially be used to identify which processes in the ED visit are correlated with increased wait time. Unfortunately, the EDPEC is still undergoing development and lacks full endorsement by the Centers for Medicare & Medicaid Services.

Emergency overcrowding and waiting times have been a growing issue for nearly two decades in the United States.²⁸ Many studies have looked into potential causes of overcrowding and waiting times. However, not much has been done at a national level

and local hospitals have been left to develop their own approaches. These interventions may have worked at individual hospitals, but there are too many differences between individual EDs to work reliably. Many emergency physicians working in large hospital settings have been forced to accept boarding and crowding.²⁹ The United States has not dealt with boarding and crowding in the ED; the UK and Canada have set target times with failure subject to financial penalty. More data from interventions into the causes of overcrowding must be done, since there is a dearth of literature on successful solutions to improving throughput.

METHODS

Study Design

This Quality Improvement (QI) Project in the Boston Medical Center Emergency Department will assess if waiting times decrease when providers check-in more frequently with patients.

Study Population and Sampling

The Boston Medical Center ED is the largest and busiest trauma and emergency center in New England. It serves a population of over 130,000 patients per year. The sample we will be using contains 100 previous patient charts for our review and 100 patients for our intervention. These patients will require more than one resource, but do not require immediate life-saving intervention or are considered high risk and have been triaged in the Emergency Severity Index (ESI) 3 category during their visit.

Inclusion/Exclusion Criteria

Table 3. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none">• ESI 3 Patients	<ul style="list-style-type: none">• Pediatric Patients• Trauma Patients• Urgent Care Patients• ES1, ES2, ES4, & ES5 Patients

Intervention

The initial step will be to perform a chart review on past ESI 3 ED patients' average waiting times during an ED visit vs. the average check-in frequency. Variables discussed during check-ins include laboratory results, radiology results, consult services, and admission/discharge planning. This will allow the researchers to determine when and how the patient is interacting with a caregiver. A process for a systematic check in process will be developed to enhance care in order to decrease waiting times caused by hold ups in care. This new process implemented into the roles of nursing, resident, and attending will be documented in the electronic medical record (EMR). After a month, average wait time and check in frequency will be reassessed to see if any significant change has occurred. Currently, patients are sent a satisfaction survey after their ED visits. We will continue to use this survey to determine if frequent check-ins improves satisfaction. We will revise based on our findings and repeat the study.

Plan

The chart review will be done on 100 charts to determine the length of an ED visit, the time the patient waited to be seen, and the amount of time that a patient is being seen during their ED visit. The charts will be drawn from patients who meet ESI 3. These are patients requiring multiple, potentially time consuming interventions, but not acute enough for emergent interventions. The time the patient checks into the ED will be noted as the beginning of the visit, the time between check in and triage will be the waiting time, and the number of check ins will be determined by the number of notes

entered in for each patient. The note types most likely to determine this are labeled ED Notes filed by a provider. These notes cover interactions such as when the nurse initially assumes care of the patient in the ED, when the patient is given an intervention (medication, IV access, imaging), or when the patient care is transferred either to a new nurse or admitted. However, this is not consistent between all patients, but each note entered by a provider will count as one face-to-face interaction and check-in.

Findings of Chart Review

The total length of stay will be plotted on the X-axis of a graph and number of ED notes by providers will be plotted on Y-axis with a linear regression to identify any correlation. We would also need to determine if total length of stay is decreased or increased due to the number of ED notes filed. The average waiting time, LOS, and check in amount will also be found. We will obtain average ED satisfaction scores from the Patient Satisfaction survey given to all patients.

Study variables and measures

- Average waiting time
- Average LOS
- Average ED Notes
- Patient Satisfaction Scores

Recruitment

We will designate a set timeframe, what is to be done during check-ins, and by whom. Stakeholders will be recruited on a volunteer basis through a sign up sheet placed in the ED. This group will be composed of ED attendings, residents, and nursing staff. We will establish the best way to implement a system that will minimally interrupt current workflow, check-in intervals, and determine if a month is an acceptable time for the project to run. We will have a goal of decreasing waiting time and LOS by half the pre-intervention times. ESI 3 patients who are being treated in the main ED will be eligible to participate.

Do

After meeting with the stakeholders and developing a plan that will not adversely affect care or increase undue burden on providers, we will roll out a plan of checking in on an ESI 3 patient every hour. This will occur over a month with a goal of 100 ESI 3 triaged patients, which should be accomplished easily with over 10,000 total patients seen a month in the ED. These patients will have an ED Note entered by the provider that acknowledges the face-to-face interaction and follow up with any interventions that need to be done. The patient will receive the same patient satisfaction survey in the mail that is given to all ED patients post visit.

Study and Analysis

We will perform a post-intervention chart review on all patients seen during the study. Patient LOS times will be compared to the number of check-ins that were done during the ED stay. This will be compared with pre-intervention visit times by plotting on the x axis the total LOS and plotting on the y-axis the number of ED notes with a linear regression to find if a correlation exists. The pre and post average LOS times will be compared using a paired T test to find a statistical significance. We will also compare the pre and post intervention patient satisfaction scores using a paired T test.

Act

We will observe if the time between check-ins is appropriate. Input from providers on how this system affected their workflow will be collected. Timing can be adjusted with their input. Statistical significance between pre and post intervention LOS and waiting times will also determine if standardized check-in times are decreasing or increasing LOS. We will take the information collected and appropriately adjust the timing or content of the check-ins.

Timeline and Resources

Table 4. Timeline of Initial Study

Intervention	Time Frame
Chart Review	1 Week
Meeting with Stakeholders	1 Week
Roll Out Phase	1 Month
Analyze	1 week

Institutional Review Board

We will submit all applicable documentation to the Boston University Medical Center IRB and seek an IRB approval for an exempt study. This study will de-identify any information that is collected, not collect any protected health information, or keep a list that can link the data. We will not obtain consent for the retrospective chart review. There is no more than minimal risk to the subjects, the waiver will not adversely affect the rights and welfare of the subject, and the research could not practicably be carried out without the waiver or alteration. A waiver of consent will also be requested for the prospective chart review carried out after the intervention has taken place, since the same lack of risk to the patient and his PIH. We will make available to the subjects any additional pertinent information that is found after participation, but this is not expected.

CONCLUSION

Discussion

The ED has many providers caring for one patient, and for this QI project to be feasible, we will need significant participation from the stakeholders. Multiple limitations will arise without significant input from staff. The biggest limitation is lack of participation, with check-ins not being recorded properly or at all. Implementing the check-in process into the workflow without preventing interruptions would create another limitation. The number of ESI 3 patients who will be seen within the time frame can be a limitation because this number can vary and not provide enough information to demonstrate statistical significance. The return of patient satisfaction surveys is a factor that will limit how we determine if patient satisfaction has changed. We will determine if the above factors will need to be adjusted to yield significant results during our initial analysis of this QI project.

Summary

ED waiting times have been a hindrance to care and patient satisfaction. This has been discussed in the literature for the last 20 years.⁸ Hospitals have tried multiple interventions to create more space and adding more providers in response to multiple studies discussing factors that cause these increases in waiting times. However, this did not cause any decrease in waiting times, but actually increased length of stay in some cases.¹⁵ Any initial gains in waiting time decreases have not been able to keep up with

demand.⁸ This is likely because waiting time is not only due to the number of patients being seen, but also what interventions patients need during their visit.

Multiple studies have looked at these interventions including a study by Kocher looking at laboratory and radiology results.¹⁶ A high proportion of ED patients receive these interventions during their visit. Reducing the wait for results is suggested to increase throughput, decreasing both length of stay and waiting room times. Wait time reduced by nearly an hour by changing some blood tests to point of care options.¹⁶

This QI project has been developed to perform check-ins on patients in order to distinguish if patient care is being held up not only by laboratory results, but also any other interventions that the patient requires. These check-ins have the added benefit of increasing patient satisfaction. McCarthy et al.⁶ showed room for increased conversation between provider and patients. Checking in more allowed the provider to build a better relationship with the patient, which increased care and satisfaction.

The next cycle of this QI project can focus on improving any difficulties with performing the check-ins every hour and the content of the discussions. We will need to identify what hold ups were identified most frequently during the study. It can be decided if some interventions can be ordered at different times to improve turn around time or if certain interventions should be ordered at all. The timing of certain interventions may need adjusting while other may be determined unnecessary.

Clinical and Public Health Significance

Creating an emergency department experience that maximizes care by increasing throughput in the ED will allow more patients to be served. This benefits the public, especially with the passage of the Affordable Care Act allowing more people access to affordable healthcare. This study also will benefit care by examining how interventions ordered during an ED visit affects care. The possibility exists that interventions with the most delayed results should be reevaluated for use in the ED and done in a different setting, which could improve care and reduce insurance costs.

LIST OF JOURNAL ABBREVIATIONS

Acad Emerg Med Off J	Academic Emergency Medicines Official Journal of the
Soc Acad Emerg Med	Society for Academic Emergency Medicine
Ann Emerg Med	Annals of Emergency Medicine
Emerg Med Int	Emergency Medicine International
Health Aff Proj Hope	Health Affairs Project Hope
Isr J Health Policy Res	Israel Journal of Health Policy Research
J Emerg Med	The Journal of Emergency Medicine
J Am Med Inform Assoc	The Journal of the American Medical Informatics Association
J Emerg Nurs	Journal of Emergency Nursing
West J Emerg Med	The Western Journal of Emergency Medicine

REFERENCES

1. Horwitz LI, Green J, Bradley EH. US emergency department performance on wait time and length of visit. *Ann Emerg Med.* 2010;55(2):133-141. doi:10.1016/j.annemergmed.2009.07.023.
2. Sayah A, Rogers L, Devarajan K, Kingsley-Rocker L, Lobon LF. Minimizing ED Waiting Times and Improving Patient Flow and Experience of Care. *Emerg Med Int.* 2014;2014:981472. doi:10.1155/2014/981472.
3. Handel D, Epstein S, Khare R, et al. Interventions to improve the timeliness of emergency care. *Acad Emerg Med Off J Soc Acad Emerg Med.* 2011;18(12):1295-1302. doi:10.1111/j.1553-2712.2011.01230.x.
4. Thompson DA, Yarnold PR, Williams DR, Adams SL. Effects of actual waiting time, perceived waiting time, information delivery, and expressive quality on patient satisfaction in the emergency department. *Ann Emerg Med.* 1996;28(6):657-665.
5. Fairbanks RJ, Bisantz AM, Sunm M. Emergency department communication links and patterns. *Ann Emerg Med.* 2007;50(4):396-406. doi:10.1016/j.annemergmed.2007.03.005.
6. McCarthy DM, Engel KG, Buckley BA, et al. Talk-time in the emergency department: duration of patient-provider conversations during an emergency department visit. *J Emerg Med.* 2014;47(5):513-519. doi:10.1016/j.jemermed.2014.06.056.
7. Institute of Medicine. *Hospital-Based Emergency Care: At the Breaking Point.* Washington, D.C.: National Academies Press; 2007. <http://www.nap.edu/catalog/11621>. Accessed December 18, 2015.
8. Derlet RW, Richards JR. Overcrowding in the nation's emergency departments: complex causes and disturbing effects. *Ann Emerg Med.* 2000;35(1):63-68.
9. Pines JM, McCarthy ML. Executive summary: interventions to improve quality in the crowded emergency department. *Acad Emerg Med Off J Soc Acad Emerg Med.* 2011;18(12):1229-1233. doi:10.1111/j.1553-2712.2011.01228.x.
10. Gibbs N. Do you want to die? The crisis in emergency care is taking its toll on doctors, nurses, and patients. *Time.* May 1990:58-65.
11. Schiff GD. System dynamics and dysfunctionalities: levers for overcoming emergency department overcrowding. *Acad Emerg Med Off J Soc Acad Emerg Med.* 2011;18(12):1255-1261. doi:10.1111/j.1553-2712.2011.01225.x.

12. Pallin DJ, Allen MB, Espinola JA, Camargo CA, Bohan JS. Population aging and emergency departments: visits will not increase, lengths-of-stay and hospitalizations will. *Health Aff Proj Hope*. 2013;32(7):1306-1312. doi:10.1377/hlthaff.2012.0951.
13. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. *Ann Emerg Med*. 2008;52(2):126-136. doi:10.1016/j.annemergmed.2008.03.014.
14. Sayah A, Lai-Becker M, Kingsley-Rocker L, Scott-Long T, O'Connor K, Lobon LF. Emergency Department Expansion Versus Patient Flow Improvement: Impact on Patient Experience of Care. *J Emerg Med*. September 2015. doi:10.1016/j.jemermed.2015.06.068.
15. Zun LS. Analysis of the literature on emergency department throughput. *West J Emerg Med*. 2009;10(2):104-109.
16. Kocher KE, Meurer WJ, Desmond JS, Nallamotheu BK. Effect of testing and treatment on emergency department length of stay using a national database. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2012;19(5):525-534. doi:10.1111/j.1553-2712.2012.01353.x.
17. Singer AJ, Ardise J, Gulla J, Cangro J. Point-of-care testing reduces length of stay in emergency department chest pain patients. *Ann Emerg Med*. 2005;45(6):587-591. doi:10.1016/j.annemergmed.2004.11.020.
18. Welch SJ, Asplin BR, Stone-Griffith S, et al. Emergency department operational metrics, measures and definitions: results of the Second Performance Measures and Benchmarking Summit. *Ann Emerg Med*. 2011;58(1):33-40. doi:10.1016/j.annemergmed.2010.08.040.
19. Eitel DR, Rudkin SE, Malvey MA, Killeen JP, Pines JM. Improving service quality by understanding emergency department flow: a White Paper and position statement prepared for the American Academy of Emergency Medicine. *J Emerg Med*. 2010;38(1):70-79. doi:10.1016/j.jemermed.2008.03.038.
20. Pines JM, Bernstein SL. Solving the worldwide emergency department crowding problem - what can we learn from an Israeli ED? *Isr J Health Policy Res*. 2015;4:52. doi:10.1186/s13584-015-0049-0.
21. Marino PA, Mays AC, Thompson EJ. Bypass Rapid Assessment Triage: How Culture Change Improved One Emergency Department's Safety, Throughput and Patient Satisfaction. *J Emerg Nurs JEN Off Publ Emerg Dep Nurses Assoc*. 2015;41(3):213-220. doi:10.1016/j.jen.2014.07.010.

22. Spaitte DW, Bartholomeaux F, Guisto J, et al. Rapid process redesign in a university-based emergency department: decreasing waiting time intervals and improving patient satisfaction. *Ann Emerg Med.* 2002;39(2):168-177.
23. Pines JM, Pilgrim RL, Schneider SM, Siegel B, Viccellio P. Practical implications of implementing emergency department crowding interventions: summary of a moderated panel. *Acad Emerg Med Off J Soc Acad Emerg Med.* 2011;18(12):1278-1282. doi:10.1111/j.1553-2712.2011.01227.x.
24. Patel PB, Combs MA, Vinson DR. Reduction of admit wait times: the effect of a leadership-based program. *Acad Emerg Med Off J Soc Acad Emerg Med.* 2014;21(3):266-273. doi:10.1111/acem.12327.
25. Harle CA, Listhaus A, Covarrubias CM, et al. Overcoming barriers to implementing patient-reported outcomes in an electronic health record: a case report. *J Am Med Inform Assoc JAMIA.* July 2015. doi:10.1093/jamia/ocv085.
26. Farley H, Enguidanos ER, Coletti CM, et al. Patient satisfaction surveys and quality of care: an information paper. *Ann Emerg Med.* 2014;64(4):351-357. doi:10.1016/j.annemergmed.2014.02.021.
27. Medicare C for, Baltimore MS 7500 SB, Usa M. ED. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/CAHPS/ed.html>. Published March 20, 2015. Accessed March 22, 2016.
28. 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 Proj Hope.* 2015;34(12):2151-2159. doi:10.1377/hlthaff.2015.0603.
29. Schneider SM. Just another crowding paper. *Acad Emerg Med Off J Soc Acad Emerg Med.* 2014;21(10):1158-1159. doi:10.1111/acem.12491.

CURRICULUM VITAE

Joshua Medeiros B.S., PA-SIII

1985

119 Winthrop St

Fall River, Massachusetts 02721

(774) 644-2597 (cell)

medeiros.joshua@gmail.com

EDUCATION

- 2014-2016 Boston University School of Medicine, Boston, MA
Master of Science, Physician Assistant Program
Degree conferred September 2016
Thesis: Improving Waiting Times in the Emergency Department
- 2003-2007 Salve Regina University, Newport, RI
B. S., Biology
Deans List Recipient, 2004, 2005, 2006, 2007
Undergraduate Lab Aide – Microbiology Laboratory

EXPERIENCE

- 2012-2014 Research Assistant II, Pulmonary Epidemiology
Brigham and Women's Hospital
Boston, MA
Closely worked with Principal Investigators, Laboratory Manager,
Laboratory Technician, Project Managers, and Research Fellows to
conduct study visits and perform physiological measurements.
- 2010-2012 Lead Lab Technician, Clinical Translational Study Unit
Boston Children's Hospital
Boston, MA
Reviewed new clinical trials and determined lab services and lab
budgets that would best fit study needs with Principal
Investigators, Study Coordinators and Nurses
- 2008-2012 Research Assistant, Clinical Translational Study Unit
Boston Children's Hospital
Boston, MA
Processed various samples for numerous research studies using
many different techniques, while maintaining lab safety standards
and inventory. Also, worked closely with nursing staff and study
coordinators to develop a standard order of practice for each
individual study.

TEACHING AND TRAINING EXPERIENCES

2015	Acute Diverticulitis 30-minute lecture Department of Surgery Roger Williams Medical Center Providence, RI
2015	Strokes One-hour lecture Department of Medicine VA Medical Center Brockton, MA
2015	Conversion Disorder 15-minute lecture Physician Assistant Program Boston University Medical Center Boston, MA

CERTIFICATION AND LICENSURE

2015-present	ACLS Certification
--------------	--------------------