Emergency Department Left without Being Seen Rates and Staff Perceptions Post-Implementation of a Rapid Medical Evaluation and a Provider in Triage

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Abstract

Increasing emergency department (ED) crowding and wait times lead to higher rates of patients who *leave without being seen* (LWBS) increasing their morbidity and mortality risk. This quality improvement project evaluated the impact of a *rapid medical evaluation* (RME) with and without a *provider in triage* (PIT) on variables that reflect ED crowding. These variables were LWBS rates, door to disposition times by acuity level [defined by *emergency severity index* (ESI)], and ED *length of stay* (LOS) by admission and discharge category. Post-RME results demonstrated a statistically significant improvement in door to disposition times for the ESI level 5 or routine patients (p=0.037). No statistically significant differences were identified in other variables of interest post-RME, despite a higher acuity population sample which may demonstrate a beneficial effect of the RME. Post-RME with PIT days were calculated to have statistically significantly longer door to disposition times (p=0.022) than RME with PIT, for ESI level 4 less urgent patients and for overall ED LOS of admitted patients (p=0.023). Additionally, qualitative findings support the overall benefit of the RME, despite mixed preferences between RME with PIT versus nurse protocols, desires for enhanced procedures, and reports of increased stress with the RME workload. Although a direct relationship between the RME and improved throughput in the ED could not be established, benefits of the RME are noted and worthy of additional investigation.

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Emergency Department Left without Being Seen Rates and Staff Perceptions Post-Implementation of a Rapid Medical Evaluation Unit and a Provider in Triage

The American Colleges of Emergency Physicians (ACEP) defines emergency department (ED) crowding as the inability to accommodate patients in a timely manner due to space (ACEP, 2008). *ED crowding* occurs when the demand for services does not match available resources; usually when there is no treatment bed or appropriate professional staff available. The inability to see patients quickly due to space constraints, intuitively results in prolonged wait times. The opportunity for improvement exists as ED wait times range from roughly an hour to 4 hours nationally (CDC/NHAMCS, 2014). The ACEP state that the primary reason for prolonged wait times is the boarding of admitted patients (ACEP, 2008). In addition, twenty-eight percent of patients have an ED length of stay (LOS) greater than 4 hours (CDC/NHAMCS, 2014), impacting the ability to bring new patients back within the ED. With longer wait times, there is a greater likelihood of patients leaving prior to care (ACEP, 2008), also called *left without being seen* (LWBS). According to Chan, et al. (2005), the LWBS rate is considered a valid indication of ED hospital overcrowding. Patients who registered but LWBS account for 2.0% of all emergency department visits, according to the 2011 National Ambulatory Medical Care Survey for Emergency Departments (CDC/NHAMCS, 2014). This national percentage gives a false impression that ED crowding is not of great concern. However, the LWBS rate varies depending on the hospital specialty service capabilities, the size of hospital, where it is located, and the characteristics of the population it serves. The severity of a patient's condition who LWBS is also variable. As a result, every patient who leaves without being seen is a cause for concern because a severely ill patient may be walking away untreated. Therefore targeted evidence based strategies to decrease LWBS are needed to

improve access to timely appropriate treatment, prevent adverse reactions, and promote healthy outcomes.

A systematic literature review was conducted to identify triage interventions and methods to decrease LWBS rates, especially during episodes of prolonged wait times or emergency department overcrowding.

PICOT Question

In an adult emergency department of an academic medical center, what triage interventions will decrease ED crowding as defined by a decreased *left without being seen* (LWBS) rate?

Input-Throughput-Output Conceptual Model

This project follows the *input-throughput-output* conceptual model (Asplin, et al., 2003). The advantage of this conceptual model is that it aids in looking at ED crowding through an ED perspective generalizable to multiple settings. This conceptual model (see Figure 1) is ideal as it was created from the perspective of the ED and was specifically developed to understand ED crowding. To address problematic areas and focus solutions, this model breaks down into three subcomponents: input, throughput, and output. It recognizes that each hospital differs in which subcomponent is the primary cause of ED crowding at their institute. *Input* is defined as factors that create demand for ED services which are emergency care, unscheduled urgent care needs, and safety-net care to vulnerable populations. *Output* describes factors that may affect ED crowding once the disposition decision is made and the patient is either discharged home, admitted as an inpatient, or transferred to another hospital. Patients that need to be admitted but do not have a bed, can affect ED *throughput* by occupying space and stressing the ED when those patients are boarded. Patients who left without being treated may return at a different time.

Throughput are the factors that affect the patient while being treated in the ED. Approaching ED throughput as a separate system helps ED personnel identify avenues within their control to improve unit efficiency and efficacy, thereby decreasing LWBS rates and ED crowding.

Review of the Literature

A systematic review of literature was conducted to identify triage processes to reduce the incidence of LWBS, including streamlining those processes to reduce throughput time. The review included Ovid Medline and CINAHL electronic databases up to April 2016 to collect the most current data available at the time (see Figure 2). The [key word (KW) "emergency department" OR MESH heading "emergency services, hospital" auto exploded], were combined with [KW "left without being seen"], and [KW "triage" OR MESH heading "triage"]. The combined 115 articles from the two electronic databases were cross-checked for duplicates and 36 duplicate articles were found. This left 79 articles for manual review for inclusion and exclusion criteria.

Inclusion criteria included any project that specifically measured LWBS in relation to a triage intervention, or rapid medical assessment area. Exclusion criteria were listed as: 1) studies that did not include LWBS as an outcome measurement, 2) studies that did not identify a triage intervention or rapid medical assessment area, 3) those without an English language full text available, 4) descriptive studies that only addressed LWBS patient demographic characteristics, 5) pediatric only interventions, and 6) studies that did not include workforce roles equivalent to the AMC, and/or did not answer the PICOT question.

Fast track streaming process, where lower acuity level patients can be treated quicker, were not included in this literature review as it was not a triage intervention and a fast track process was already implemented in this ED. Randomized controlled trials (RCTs), and quasi-

experimental cohort studies, and case studies were included in this review. Seventeen studies were identified that met inclusion criteria.

Summary of Data

The systematic review of literature resulted in three published systematic reviews (see Table 1), and 14 evaluation studies (see Table 2), including 11 evaluations of the addition of a provider in triage (PIT), two evaluations of the utilization of Lean® bundled interventions, and one evaluation that utilized both a PIT within their Lean® bundled interventions.

Systematic Review of Triage Interventions Measuring LWBS. Bullard, et al., (2012) reviewed four studies on the effect of a rapid medical assessment intervention on ED crowding metrics. This system replaced a traditional fast track unit but was capable of conducting more interventions than the previous system. The patients are never assigned a bed; instead, they are only brought into a treatment area when physical assessments, discharge instructions, or interventions are conducted. These patients complete their visit in the rapid medical assessment area. A statistically significant reduction in the LWBS rate was shown in one of only two studies that measured LWBS rates. These two studies were conducted outside of the United States with universal healthcare. Bullard, et al., (2012) concluded that there was limited evidence for the use of a rapid medical assessment related to mixed results and the small sample of studies.

Rowe, et al., (2011) conducted a systematic review on the ED triage liaison physician, which included the PIT interventions to combat ED crowding. The systematic review included 13 journal publications, 12 abstracts, and three web-based articles. The strength of this systematic review is that it included both published and unpublished studies to attempt to overcome publication bias. Twelve studies reported LWBS rates with mixed results. There was a significant decrease in LWBS rates for five studies and a not statistically significant (*n.s.*)

decrease in three studies, including a RCT, which was nearly statistically significant (RR=0.82; 95% CI=0.67 to 1.00). Overall, there was a 20-40% reduction in LWBS rates. No pooled data was reported as there was high heterogeneity (I2 >90%). Rowe, et al., (2011) states there is a positive influence but, due to non-RCT study design and heterogeneity of studies, they did not recommend widespread use. Instead Rowe, et al., suggested that further research is required before widespread recommendation.

The third systematic review conducted by Orredson, et al., (2011) reviewed all triage-related interventions to improve ED patient flow. Orredson, et al., (2011) states there is a strong effect of *team triage*, which included a PIT plus nursing and or tech staff, to decrease LWBS rates. Ten out of the included thirty-three studies measured LWBS rates. Four team triage studies decreased LWBS rates with moderately strong evidence. One out of the three studies which addressed LWBS rates related to streamlining processes that were not fast track, reduced the LWBS rate from 2.3% to 1.6%. Orredson, et al., (2011) also stated there was moderately strong evidence for a fast track to decrease LWBS rates.

Evaluation Studies. There were 14 original studies included in the systematic review of literature that measured LWBS rates. Two themes were identified: PIT and Lean® bundled interventions. Lean® processes are a way for emergency departments to customize interventions and reduce waste or unnecessary work which may reduce LWBS rates.

Twelve original studies pertained to the PIT which included one single blind cluster RCT, ten quasi-experimental studies including eight before and after studies, and one case study. A PIT decreased LWBS rate in a majority of studies (Burlingame, 2009; Chan, et al., 2005; DeFlitch, et al., 2015; Han, et al., 2010; Levsky, et al., 2008; Ng, et al., 2010; Soremkum, et al., 2014;& Xi & Dalal, 2015) and a nearly statistically significant decrease (p=0.06) in an additional RCT (Cheng,

et al., 2013). Nestler, et al. (2014) did not have a statistically significant overall change in LWBS but did have an increased LOS for lower acuity patients. This study was resource neutral and moved the physician assistant (PA) from the fast track position and placed them in triage (see Table 2). ED LOS decreased in eight studies focusing on a PIT (Cheng, et al., 2013; Han, et al., 2010; Levsky, et al., 2008; Ng, et al., 2010; Partovi, et al., 2001; Soremekun, et al., 2014; Traub, et al., 2015; & Xi & Dalal, 2015). PIT composition varied between studies with level of physician (MD) experience and some studies combined the use of MDs, with PAs and/or nurse practitioners (NP).

Two quasi-experimental studies and one case study pertain to utilization of Lean® in the ED. All three studies described large bundles of Lean® interventions. Lean® principles are touted to streamline strategies, standardize processes, and remove waste or nonvalue added work.

Three studies reported fewer patients who LWBS and decreases in both ED LOS and wait times, after bundled Lean® interventions (DeFlitch, et al., 2015; Ng, et al., 2010; Preyde, et al., 2012). Preyde, et al., (2012) study had a large clinically significant reduction in wait times, 11.11 to 9.95 hours for admitted patients and 3.95 to 3.29 hours for non-admitted patients. DeFlitch, et al. (2015) did include a PIT as part of its interventions. The largest decrease in ED LOS was for the lower acuity patients (Ng, et al., 2010).

Three evaluation studies measured an increase in overall patient satisfaction (Burlingame, 2009; DeFlitch, et al., 2015; Ng, et al., 2010). However, Burlingame was the only study to measure staff satisfaction which resulted in no significant changes (2009).

Discussion/Conclusion

Provider in Triage. It is important to note the heterogeneity of settings, study design,

and the credentials of the PIT (see Table 2). This heterogeneity limited the generalizability and clarity of the PIT intervention. Majority of studies used MDs only, but many studies used a combination of MDs and PAs. Another studied the effect of only PAs, and one studied the effect of only family medicine residents. The ED physician level varied from board eligible or board certified emergency physicians to attending physicians, or did not specify if emergency department residents were used. Some studies also added a nurse or EMT to the triage team. Although the literature, including ACEP, used the phrase 'physician in triage' instead of 'provider in triage', the evidence shows that mixed MD and PA, and NP and PA providers also were effective in reducing LWBS rates. The Nestler, et al., (2014) study demonstrated decrease in their LWBS rate and an increase ED LOS, although not statistically significant. This finding does not necessarily imply that a PA could not be effective in this role. Rather the effect of eliminating a fast track area may be greater than having a PIT. Training, staff levels, culture, physical space, and physician preference could also influence implementation. Yet it is compelling that the interventions produced positive results across the various confounding factors.

Additional replication studies with standardized processes are required to increase the strength of evidence and address ED crowding. Given the positive outcomes identified in the literature and the low risk of adverse events, additional efforts to optimize the PIT after implementation of a fast track process seem reasonable to further combat LWBS rates.

Lean® Interventions in Triage. Two quasi-experimental studies and one case study utilized Lean® interventions. The Lean® approach to the creation of efficient systems are applicable to the ED environment in which it is necessary to triage, stabilize, diagnose, and transfer the patient to the appropriate level of care as quickly as possible. Lean® training reduces

unnecessary steps or redundant work. Lean® interventions vary and are customized to the setting. Lean® interventions in these reviewed studies included a new barcode registration, 5-S Lean® supply organization (Preyde, et al., 2012), and early intervention implementation in a rapid assessment area (Preyde, et al., 2012). In Preyde, et al., (2012) hospital inpatient nursing staff would also "pull" patients instead of ED staff "pushing" them to the floor. In contrast to the PIT, Ng, et al., (2010) included a work driven triage system in which the triage nurse categorized patients into an anticipated discharge, admit, or uncertain category. There was an approximate 86% sensitivity for triage nurses selecting the correct category and about one in seven patients were categorized "uncertain" at triage (Ng, et al., 2010).

However, because of the nature of the Lean® bundled study interventions, the outcome data is blended and the reader is unable to determine which intervention was most effective. Despite this, the overall effect appears positive. Lean® approach can be customized to different hospital setting and should be considered to make a hospital ED more efficient. Cost analysis should be conducted also as additional time is required for the frontline staff to be engaged and involved in these processes. EDs should eliminate waste but remember to keep value added time. Time searching or waiting is waste. However, the increased length of time because the nurse is teaching a patient how to check their blood sugar on their new glucose machine and what to do if glucose is high adds value, and may prevent future ED visits.

Conclusion

This systematic review of literature resulted in three systematic reviews, one RCT, eleven pre-post quasi-experimental studies and one case study. There is moderate evidence for the use of a PIT to mitigate ED crowding. The intervention is associated with a decrease in LWBS in a variety of ED settings. It did not have a stronger recommendation as there was only one RCT. As

a result, EDs should consider instituting a PIT for increased LWBS rates. The aforementioned ACEP Task Force report (2008) also supports consideration of the PIT in areas that have an overwhelming capacity. The few studies that measured LWBS related to Lean® bundled interventions are individualized to each setting and have shown a decrease in LWBS rates. The bundled interventions show a positive effect, but no conclusions can be made as to which intervention had the greatest effect. This health system and ED are already conducting Lean® process interventions. As a result this DNP capstone will focus on the provider in triage utilization to impact LWBS rates.

Methods

Project Question

For emergency department (ED) patients arriving at an academic safety net hospital, does a rapid medical evaluation (RME) with and without a PIT, versus no RME, decrease ED crowding metrics as indicated by LWBS rates, door to disposition times by acuity, and ED LOS by admission or discharge category?

Additional questions: What are the perceptions of ED nurses and/or emergency medical technicians (EMTs) regarding PIT/RME on ED operations?

RME/PIT Project Background

This ED has variable LWBS rates, some of which surpass the 1.8% unit goal. The higher than desired LWBS rates in the ED are attributed to multiple patients boarding. This results in reduced bed availability for patients seeking care, increased wait times, and an inability to effectively initiate treatment during these high volume periods, together which contribute to ED crowding.

To combat ED crowding, ED leadership collaborated with a hospital-based systems

engineer who analyzed January 2012 to December 2014 ED data. During this period, Monday was the busiest day of the week with a 6% higher volume at this institute. Specifically, Mondays from 1:00-10:00pm usually had the greatest census and was frequently at capacity (then 41 beds) by 2:00pm (Valdez, J., unpublished 2016). Patients were unable to be treated in a timely manner; Emergency Severity Index (ESI) category 3 patients had the highest average waiting time from triage to room (2016).

The American Colleges of Emergency Physicians Task Force report on ED crowding (ACEP, 2008) recommended that EDs with overwhelming capacity issues institute a program that places a physician in triage to identify and initiate care for higher acuity patients and who could discharge minor patients. This additional physician resource adds a cost that should be considered with implementation. However, there are potential time savings by initiating interventions earlier as 60% of ED visits are ordered labs and around 40% have a radiologic exam (Valdez, J., unpublished 2016). The ACEP (2008) note that initiating diagnostic interventions, patient care, and discharge are secondary to the primary function of triage. The Emergency Nurses Association position statement on *Holding, Crowding, and Patient flow,* did not make specific intervention recommendations but recognizes that crowding is a hospital-wide systems issue and encourages emergency nurses to be involved in research, development and solutions to address crowding (ENA, 2014).

A new physical space in the ED was opened in spring 2016 to support early diagnostic interventions and protocols called the Rapid Medical Evaluation (RME). The unit also conducted an initial pilot period with a PIT. However, a formal PIT process was not established.

Purpose of the Study

This DNP capstone has two components:

RME/PIT. The purpose of this quality improvement project is to evaluate the impact of the RME, with and without a dedicated PIT, on ED crowding metrics. Measures include LWBS rates, door to disposition decision time by acuity, and ED LOS by admission or discharge category.

Focus Groups. This qualitative component of the project was to describe the nursing and ED tech staff perceptions regarding the RME and PIT on ED operations, including perceived benefits and areas for improvement. Only one study reviewed, Burlingame (2009), measured overall staff satisfaction and demonstrated no significant difference. However, to the author's knowledge there are no studies that specifically explore the experience and impact of the RME/PIT intervention on nursing/EMT staff.

Hypotheses

Hypothesis 1. The overall ED LWBS rate, ED LOS by admission and discharge category, and door to door disposition time by acuity will decrease post-implementation of a ED RME when compared to pre-implementation data.

Hypothesis 2. ED data on patients seen by a dedicated PIT will demonstrate a greater reduction in LWBS rate, ED LOS by admission and discharge category, and door to door disposition time by acuity, versus RME without a dedicated PIT.

Hypothesis 3. Nursing and EMT staff may have mixed feelings working with a dedicated PIT but will perceive an overall benefit to the patient with the PIT.

Protection of Human Subjects

Institutional Review Board (IRB) approval was obtained from the IRB for Health Sciences Research (IRB-HSR), prior to initiating the RME project. The project received expedited status from the IRB. Approval was also obtained from the IRB for Social and Behavioral Sciences

(IRB-SBS), prior to initiation of the focus groups. During the project, medical record data were maintained in a secure hospital server. To protect patient confidentiality, all personally identifiable information was removed before aggregation of data in accordance with the Health Insurance Portability and Accountability Act (HIPPA) of 1996, Privacy Rule in 2002, and Security Rule in 2003. Investigators leading the project had current Collaborative Institutional Training Initiative for Human Subjects Research certification. Typed consent forms were provided and verbal consent was obtained for transcription prior to each focus group for continued participation. Transcribers were not familiar with participants and no names were recorded on transcription of focus group sessions. Transcriptions were kept by the investigator in a secure location. Only non-ED leadership project personnel were allowed to review transcription to allow participants to speak freely without any undue influence. The investigator had no authority over nursing staff or conflicts of interest (see Appendix A). Approval of this DNP capstone was obtained from the ED nurse manager and medical director.

Definition of Terms

Emergency department crowding. The American Colleges of Emergency Physicians (ACEP) Task Force on Boarding published the report *Emergency department crowding: High impact solutions* (ACEP, 2008). The report explained that ED crowding exists when there are no available treatment spaces to take care of presenting ED patients in a timely manner (ACEP, 2008), increasing morbidity and mortality. ED crowding metrics include the following three terms: left without being seen, door to disposition decision time, and ED length of stay.

Left without being seen. Left without being seen (LWBS) is a term used for a patient who registered in the emergency department and left prior to being seen by a provider. There is a greater likelihood of patients leaving prior to care with longer wait times (ACEP, 2008).

Door to disposition decision. Door to disposition decision is the time from when the patient registered in the ED to the time that the ED provider placed the disposition decision order for admit or discharge home. This timeframe includes triage, possible RME intervention, treatment bed placement in main ED, provider assessment, and any associated examinations, treatments, or interventions. This project will measure door to disposition times by acuity level (defined by Emergency Severity Index level) to acknowledge differences in time required by patient acuity.

Emergency department length of stay. Emergency department length of stay (ED LOS) is the time from when patient registered to when they physically left the emergency department.

Emergency Severity Index. The Emergency Severity Index (ESI) is a reliable and valid five level triage system that sorts and prioritizes the order in which to treat patients related to a combination of acuity and the number of resources utilized, from 1 (most urgent) to 5 (non-urgent without requiring resources) (Gilboy, et al., 2011). ESI level 1 is the most urgent and requires an immediate lifesaving intervention. Lifesaving interventions may include immediate airway, emergent medications/ interventions to maintain breathing and circulation. An ESI level 2 patient is in a high risk situation which has potential to require life-saving interventions and closer monitoring. Patients who are acutely confused/ disoriented, or in severe pain or distress could also be ESI level 2. ESI levels 3, 4, 5 are more stable patients differentiated by the number of resource types required. Resources are blood draws, radiologic examinations, EKGs, procedures, IV fluids, and specialty consultation. ESI level 4 requires one type of resource, ESI 3 requires two or more resource types, and ESI level 5 should not require any resources. Typically ESI level 1 and 2 patients are triaged at bedside upon arrival by ambulance but they could also walk in and be identified in triage.

Triage nurse. The triage nurse is a registered nurse (RN) who quickly evaluates and assigns the new patient an ESI category based upon a combination of acuity and resources required. The goal of triage is to sort the patients by assigning the ESI category and to identify which patient should be placed in the next available ED treatment bed.

Rapid medical evaluation or rapid assessment. Early diagnostic interventions in the traditional triage area have been called rapid assessment and or rapid medical evaluation (RME). Unlike some hospitals, RME is not the fast track unit or replacement of a fast track unit where lower acuity patients are quickly seen. This institute used a RME in addition to a traditional fast track unit. At this institute, RME describes the physical space where a triaged patient could receive early diagnostic interventions if direct bed placement is not available during periods of high patient volume. This lack of space typically results with longer wait times. The RME is optimally staffed with a triage nurse, intake nurse, and two ED techs to support the triage and diagnostic intervention functions. There may or may not also be a dedicated PIT in the RME.

Provider in Triage. This DNP capstone used the term 'provider in triage' to reflect the evidence that physicians, PAs, and NPs have been shown to decrease LWBS rates. Provider in triage (PIT) in this project refers to a third year emergency medicine resident under the supervision of an attending emergency medicine physician. The PIT determines whether a patient in the RME would benefit from initiating labs/treatments prior to placement in the main ED. If so, the PIT orders initial diagnostic labs, or radiologic exams, review order results, and could also discharge patients from the RME.

Intake nurse. The intake nurse is an RN who coordinates with both charge nurse and nursing staff to place patients in a main ED space. The intake nurse may be in charge of other miscellaneous activities to expedite patient placement and will also triage when a large amount

of patients need to be evaluated.

Emergency department technician. An emergency department technician (ED tech) at this institute must at minimum also be certified as an Emergency Medical Technician-Basic Level. The tech is trained and certified in basic life support and maintains responsibilities for activities such as conducting the majority of EKGs, locating a MD to review that EKG, performing blood draws, obtaining intravenous access, taking patients to radiology, and at times, pulled to sit with mental health evaluation patients, with suicidal or homicidal intent to harm.

Research Design

This DNP capstone design includes a quantitative and a qualitative approach. The quantitative component is a quality improvement project evaluating the RME, with and without the PIT, as compared to prior to the RME implementation. The second component collected ED nurses' and ED techs' perspectives about the RME/PIT program and its impact on ED operations. Demographics were collected on the focus group participants.

Project Sample Description

RME/PIT sample. Data for this evaluation was collected from the Electronic Medical Record (EMR) of ED patients. Data were obtained from already collected ED reports that compiled EMR data on patient data including patient acuity, chief complaint, and time registered, door to MD by acuity, MD to disposition decision by acuity, and ED LOS by admission and discharge category. Race, ethnicity, age, gender, and payor information was generated report from information obtained through an additional registration system. Pre-implementation data were pulled from the records of all adult and pediatric patients who registered in the ED on Mondays prior to RME/PIT implementation. Post-implementation data included the records of all adult patients who registered in the ED on Mondays during the two month evaluation period

when the RME was operational. Mondays were chosen as the designated day because it has the largest patient volume during the week. Patient records were excluded if they had a chief complaint that required a mental health evaluation.

Focus group sample. Nurses and ED techs who have either worked in the RME or were assigned a patient who had interventions in the RME, and who volunteered to participate were included in the focus group sample. Any employee who was not a registered nurse or ED tech was excluded.

Setting

The site for this DNP capstone was the ED at an academic medical center (AMC). The ED registers approximately 61,000 annual visits with an approximate 25% admission rate from these visits. The AMC is a rural safety net tertiary care hospital. The ED had a variable LWBS rate higher than the 2011 national average of 2.0% and has established a department goal of 1.8%. The RME/PIT program is being housed in a newly selected area of the ED that is an expansion of the old triage space with five spaces available for either triage, and diagnostic or treatment interventions.

Rapid Medical Evaluation and Provider in Triage

The RME became operational when at least two criteria were met indicating high ED volume (see Figure 3). Criteria included if the longest wait time in the waiting room exceeded 60 minutes and if there were five or more incoming ambulance squads. The goal of the RME was to initiate early diagnostic interventions when it was anticipated that there was going to be a delay in care. If main ED beds were available or the anticipated wait was less than 30 minutes then no interventions were to be done in the RME, with the exception of EKGs for chest pain. Triage of patients was to take precedence over initiating RME interventions and discharges.

RME/ PIT Procedures

Staff were educated on RME process prior to each shift. Triage in RME typically took place in either of 2 locations. Then the triage nurse would place them in one of four bays, if they anticipated diagnostic interventions such as labs, EKG, or a radiologic exam, may be required. The goal of RME intervention was to begin diagnostic evaluation, spending less than 15 min in a bay, and then return the patient to waiting room until the patient could be placed in a treatment space. RME evaluation/ interventions were not done if wait times were short and patients could be directly bedded to main ED, express care, or pediatrics.

For two months, the RME was staffed with two RNs and two ED techs on Mondays. This workforce pattern represented an additional ED tech resource which was greater than normal staffing level. One RN acted as the primary triage nurse and the other as the intake nurse who focused on patient placement and triaged as needed. Of the eight project days, four days also had a dedicated PIT work in the RME.

At this location, the PIT was a third year emergency medicine resident under the supervision of an emergency medicine attending physician. The third year residents voluntarily signed up for shifts in the RME as the dedicated PIT, which was normal practice. The established RME hours were from 1100 to 1900 and reflected the largest patient volumes in the department. This project was conducted from September 12th through October 31st, 2016. The project captured data on the ED workflow on Mondays only so as to not introduce variability due to day of the week. There were four shifts with a dedicated PIT in RME and four shifts without a dedicated PIT as the comparison group.

On days with a dedicated PIT, nurse protocols were not utilized and all orders were placed in the computer by the PIT. The exception was the Chest Pain Protocol so that if the

provider was occupied in another RME room, the ED tech or RN did not have to wait for an order. This allowed RME staff to continue to initiate EKGs as soon as patients presented to the ED. Dedicated PIT either listened passively to triage assessment or evaluated them once placed in RME bay. All nursing protocols were initiated in the RME on days without a dedicated PIT.

Focus Group Procedures

At the end of the RME evaluation period, three volunteer focus groups were held to collect nurse/ED tech experience with the RME and/or PIT. Verbal consent was obtained prior to the start of semi-structured interview. Focus group participants had the ability to leave at any time. Only non-department leadership project personnel had access to transcription of the focus group discussions and demographic data. Demographic data for participating ED nurses and techs were obtained and included: age, gender, ethnicity, years of overall nursing experience, number of years with experience as an ED nurse/tech, experience working in RME, and experience receiving a patient that had interventions completed in the RME. Semi-structured interview questions were introduced to three focus groups in December 2016 after the RME/PIT implementation.

Five interview questions were asked to the individuals in the group.

1. What is your experience directly working in the RME with either a dedicated Physician in Triage or with the Physician Triage Liaison by Team?

2. While working in the main ED, what is your experience receiving patients who had interventions initiated in the RME; such as labs, IVs, and or x-rays?

3. What are additional opportunities for improvement with the RME/PIT?

4. What are the additional benefits of the RME/PIT?

5. Is there anything we haven’t addressed that should be discussed with respect to

RME/PIT?

Information was transcribed to maintain anonymity and confidentiality of participants.

DNP Capstone Timeline

See Figure 4 for project implementation timeline.

August 2016: Educated staff working in RME on the most current standard work and goals. Identified times with leadership to do post-intervention focus groups. Collected data from EMR on 2015 comparison group.

September 2016: Started RME project with full staffing (2 RNs, 2 ED techs, +/- an MD) on consecutive Mondays for 3 months beginning Monday, September 12, 2016.

September through November 2016: Collected data on LWBS, door to disposition times, and ED LOS concurrently with study.

December 2016: Conducted three focus groups with semi-structured interviews.

January/February 2017: Analyzed quantitative and qualitative data.

Measures

RME/PIT. ED crowding metrics were measured in pre- and post-RME, and on RME days w/o PIT and w/ PIT. These variables were LWBS rates, door to disposition decision-time by acuity level, and overall ED LOS by admission and discharge category. Demographic patient data obtained from the electronic database included: age, gender, ethnic background, ESI triage category, admitting complaint or diagnosis, and payor information.

Focus Group. Demographic nurse and ED tech data collected included: age, gender, ethnic background, years of overall nursing experience, number of years with experience as an ED nurse, and if staff had experience working in RME.

Data Analysis Plan

RME/ PIT data analysis. ED crowding metrics were obtained from databases and management systems already reporting patient level data. Pre-RME implementation data were obtained from consecutive Mondays in 2015 within the September 14 through November 02, 2015 time frame. Similarly, post-RME implementation data were obtained from consecutive Mondays; September 12 to November 02, 2016. The analysis was completed in coordination with and reviewed for accuracy by a statistician using IBM SPSS Statistics v. 24. Pre-implementation data were compared to overall post-implementation on Mondays from September 12 to November 02, 2016. There were two post-implementation RME comparison groups: one group without a dedicated PIT and one with a dedicated PIT. All variables of interest were analyzed. Descriptive statistics were computed on demographic data, Pearson's chi square was conducted on nominal data. A simple t-test was used to compare mean door to disposition time by acuity, mean ED LOS by admission and discharge category. Descriptive statistics were also calculated for these variables including the number and percentage of patient encounters who LWBS.

Focus group data analysis. Nurse/EMT focus group demographic data including age, gender, ethnic background, experience as a nurse, experience as an ED nurse, and experience working in RME were analyzed with simple statistics using Microsoft Office Excel v. 2013. Written and typed transcription of focus groups were completed by the same two project personnel for each focus group session. Transcripts were reviewed only by project personnel not working in this ED to maintain confidentiality and anonymity. Themes were identified. Disagreement of themes were discussed and agreed upon by consensus. Transcription was destroyed upon completion of the DNP Capstone.

Project Results

Quantitative Analysis:

RME Evaluation. Of 1,472 patient encounters in the 2015 pre-RME project period, 55 were excluded for a chief complaint that required a mental health examination. Of 1,524 people who registered in the ED during the 2016 post-RME project period, 55 patient encounters which had a chief complaint that required a mental health evaluation were excluded. The pre-RME data set included 1,417 patient encounters compared to 1,469 patient encounters in the post-RME project period (see Table 3). A total of sample of 2,886 patient record encounters were included for analysis.

The average patient in 2015 on pre-RME days was about 41 years old, and the majority of patients were non-Hispanic (93.8%), female (51.6%), and white (66.0%). The average patient in 2016 on post-RME days was about 42 years old, and the majority of patients were also non-Hispanic (93.7%), female (54.6%), and white (65.3%). Pearson's chi square demonstrated no statistically significant difference in *age*, *gender*, *ethnicity*, *race*, or *disposition* between project samples pre- and post-RME. Of the known pre-RME payor sources, 26.7% of patients had private insurance, 21.6% had Medicare, 18.4% had Medicaid, and 22.7% were self-pay. Of the known post-RME payor sources, 22.8% of patients had private insurance, 21.0% had Medicare, 15.8% had Medicaid, and 18.7% were self-pay. A Pearson's chi square did note a statistically significant difference in insurance payor ($p=0.000$). However, there was also a larger percentage of payor information that was unknown (20.6%) in 2016 compared to 2015. No majority payor was identified. Approximately 67% of patients were discharged from the ED and 26% were admitted to the medical center during the project period (see Table 4). The majority of pre-RME patients were ESI 3 (56.7%), followed by ESI 4 (24.9%), and ESI 2 (12.6%). The majority of

post-RME patients were ESI 3 (58.8%), followed by ESI 4 (22.1%), and ESI 2 (15.1%). The volume of more urgent patients in ESI level 2 (n=222) and urgent ESI 3 (n=864) was increased from the previous year (n=178; n=804, respectively). Pearson's chi square demonstrated a statistically significant difference (p=0.029) in acuity pre- and post-RME.

Eighty out of the 1417 patient encounters in the Pre-RME project period were associated with a LWBS incident (5.6 %) (see Table 4). In the 2016, post-RME period 79 people out of the 1469 persons left without being seen, accounting for 5.4 percent. The LWBS rate decreased in the post-RME period but was not statistically significantly different (p=0.585), despite having a statistically significantly increase (p=0.029) in acuity with post-RME patients.

The mean 'door to disposition' times were calculated for each designated patient acuity level. Of those encounters meeting criteria (see Table 5), Pre-RME the approximate mean door to disposition times for the higher acuity ESI 2 was 3 hours and 36 minutes, ESI 3 was 4 hours and 46 minutes, ESI 4 was 3 hours and 11 minutes, and the lowest acuity ESI 5 was 2 hours and 59 minutes. Post-RME, the approximate mean door to disposition times for the higher acuity ESI 2 was 4 hours and 3 minutes, ESI 3 was 4 hours and 52 minutes, ESI 4 was 2 hours and 57 minutes, and the lowest acuity ESI 5 was 2 hours and 1 minute. A t-test computed on the mean 'door to disposition' times did not demonstrate a statistically significant difference between the pre-RME and post-RME groups. However, an increase in acuity levels was noted between the pre and post samples (p=0.029). Moreover, there was a statistically significant decrease in door to disposition times for the lower acuity, ESI 5 patients, who do not usually require additional resources. On average, there was a decrease of approximately 59 minutes for ESI 5 patients treated in the RME.

The ED LOS of admissions and ED LOS of discharges were collected pre- and post-

RME (see Table 5). The mean ED LOS for admissions were 8 hours and 9 minutes Pre-RME, and 7 hours and 56 minutes post-RME. The mean ED LOS of discharges were 4 hours and 32 minutes pre-RME, and 4 hours and 36 minutes post-RME. A t-test on the mean ED LOS times by category demonstrated no statistically significant difference pre and post-RME.

RME w/o PIT v. RME w/ PIT Results. A sample of 1,469 patients met inclusion criteria and were included in the project. They were then further categorized into RME without a provider in triage (RME w/o PIT) days and RME with provider in triage (RME w/ PIT) days. RME w/o PIT sample had 755 patient encounters and RME w/ PIT days had 714 patient encounters (see Table 6). The average patient on RME w/o PIT days was 41 years old, and the majority of patients were non-Hispanic (94.0%), female (56.0%), and white (65.6%). The average patient on RME w/ PIT days was 42 years old, and the majority of patients were also non-Hispanic (92.8%), female (53.1%), and white (64.9%). The sample of RME w/o PIT patients were predominantly ESI 3 (58.3%), followed by ESI 4 (21.9%), and ESI 2 (15.9%). The sample of RME w/ PIT patients were also predominantly ESI 3 (59.4%), followed by ESI 4 (22.4%), and ESI 2 (15.9%). There was no statistically significant difference in age, gender, race, ethnicity, disposition, or acuity, between the RME without PIT and RME with PIT groups. Of the known RME w/o PIT insurances payors, 20.0% of patients had private insurance, 18.9% had Medicare, 14.3% had Medicaid, and 16.2% were self-pay. Of the known RME w/ PIT insurance payor sources, 25.8% of patients had private insurance, 23.1% had Medicare, 17.4% had Medicaid, and 21.4% were self-pay. A Pearson's chi square noted a statistically significant difference in insurance payors between RME w/ and w/o PIT also ($p=0.000$). Twenty-nine and one-half percent of payor sources were unknown in the RME without PIT group compared to 11.1% unknown in RME with PIT. There were higher percentages throughout the majority of payor

categories in the RME with PIT category.

There were 40 patient encounters out of 755 of patients who registered and then LWBS or 5.3% on days of RME w/o PIT (see Table 7). On RME w/ PIT days there were 39 people out of 714 who LWBS or an increase to 5.5%. Pearson's chi square calculated no statistically significant difference in disposition (p=0.482).

Of those encounters meeting criteria (see Table 8), on RME w/o PIT days the approximate mean door to disposition times for the higher acuity ESI 2 was 4 hours, ESI 3 was 4 hours and 44 minutes, ESI 4 was 2 hours and 44 minutes, and the lowest acuity ESI 5 was 1 hour and 44 minutes. On RME w/ PIT days the approximate mean door to disposition times for the higher acuity ESI 2 was 4 hours and 6 minutes, ESI 3 was 5 hours, ESI 4 was 3 hours and 12 minutes, and the lowest acuity ESI 5 was 2 hours and 18 minutes. Between the RME days without and with PIT, it was demonstrated that there was no statistically significant difference between mean door to disposition time by acuity except for ESI level 4 (p=0.022) the average RME with PIT day was on average 28 minutes slower than on RME days without PIT.

There was a statistically significant difference (p=0.023) between the ED LOS of those admitted on RME days without and with a dedicated PIT. On average it took 8 hours and 25 minutes for patient admissions category to the hospital to leave the ED. This was 53 minutes greater on average than on RME days without a PIT (7h:32m). There were 975 ED discharges during the project period in which there was no statistically significant difference in the average ED LOS of discharges comparing RME w/o PIT days (4h:26m) to RME with PIT days (4h:46m).

Qualitative Analysis: Focus Groups

Demographic sample results. A total of fifteen registered nurses and ED techs participated in 1of 3 hour long focus group sessions in December 2016. All participants either

worked directly in the RME and or had knowingly received patients in the main ED who had interventions completed in RME. The majority of participants were female (86.7%) and non-Hispanic white (80.0%). The median age of participants was 30 years old. The median number of years that focus group participants had as a nurse or tech was 6.5 years of experience, in which 5 of those were working in an emergency department. The median was reported because the data were skewed.

Themes. Four prominent themes resulted from the five semi-structured interview questions regarding ED nurse and tech perceptions of the RME and PIT experiences. The focus group themes are:

1. RME area was beneficial.
2. Mixed preferences between working with or without a PIT.
3. Desire for enhanced procedure.
4. Increased stress with RME workload.

Theme 1: RME area was beneficial. Focus group participants identified an overall benefit to having a Rapid Medical Evaluation area. Benefits identified were an increase in patient safety with recognition of treating higher acuity patients promptly, staff satisfaction related to physical space and empowerment to initiate diagnostic interventions, and a decreased workload for the main ED staff. One nurse stated that she could "start protocols and catch sicker patients early". Examples were given of such patients who had been sent directly to the OR from RME.

The focus group participants appreciated the new physical space as it was a large improvement from the previous space. The RN staff felt more satisfied with the RME. One nurse said "the waiting room is wasted time". They felt more useful as RNs if they had the option/ability to initiate orders especially if they anticipated they would need to be done at some point in their ED encounter. Charge nurses also felt the RME was helpful when there was no bed available for patients coming in by ambulance orders to initiate orders "instead of feeling like

you had no options. Nurses said they were also learning more in the RME. One nurse stated she felt she was learning by being in the RME by doing labs patients were identified that "are sicker than we anticipated due to the protocols."

The main ED RNs also appreciated when patients had been through the RME. Multiple nurses stated that they felt they could take an extra patient and one nurse even stated felt she could take two admissions back at once. The nurses felt they had more time to talk to the patient and "care more" when receiving patients in the main ED.

Theme 2: Mixed preferences between working with or without a PIT. The RME staff preferences for either working with or without a dedicated PIT were mixed. Many staff members saw benefits and disadvantages to both interventions. ED staff felt the efficiency and benefits were both volume and provider dependent. This also was applicable to which nursing and tech staff were working in the RME. "Two strong triage nurses… could just knock [triage] out." Participants felt that RME days without PIT were more efficient with nurses triaging and placing orders. Staff acknowledged variability in nurse's tendency to order protocols and less medications were given also. Comparatively, RME staff felt the PIT slowed patient flow in the RME as they could not get to the next person to triage.

Many techs appreciated having a dedicate PIT so they didn't have to "waste time searching" for a provider in the main ED and instead had a physician available to evaluate patients right away. Some nurses appreciated having immediate access to the provider perspective in triage. Other RME staff stated the ability to discharge patients from triage was a benefit to less acute patients and the ED as it could free up more rooms. However, they were unsure how much time was saved since the PIT was a resident and still required an attending physician approval before the patient could be discharged. Another staff member felt nurses were

more conservative with labs so overall ED time was not saved if the provider still had to add more complete lab work.

Theme 3: Desire for enhanced procedure. Focus groups also identified a desire for enhanced procedure within the RME. Staff were clear about intent of the RME space for interventions however many questions were asked by staff, unclear about specific process flow internally and during transitions. Focus group discussions included desires for having a physician to routinely review the labs results of patients in the waiting room, a process for determining which patient to begin with when opening RME with multiple patients in the waiting room, and clarifying RME scope of medications/treatments. Both ED nurses and techs felt that further defining roles, expectation, and responsibilities in light of their new abilities would increase patient safety. However, some other more experienced nurses did not want a restrictive policy in order to allow for flexibility in RME treatments especially when no main beds were available.

Theme 4: Increased Stress with RME workload. The implementation of the RME, changed staff workload on both days with and without the PIT. There was overall consensus from both nurses and techs that the ED techs were an "integral part" of having an RME function. A tech stated that they would be "crushed for four hours" and another more experienced tech found he/she was "more burnt out" after working in the RME. The same tech acknowledged that this was one reason for the change to four instead of eight hour ED tech shifts in the RME.

When the RME was open, the nurses stated that majority of the initial workload was now frontloaded and completed in the RME instead of in the main ED. Some of this workload and stress was attributed to time searching for equipment and retrieving medications from the main ED to administer in the RME particularly if there were multiple people to triage.

Because of the increased workload/environment in the RME, staff felt RME required additional staffing resources, either more techs, float, or flow coordinator, depending on the patient volume. Another staff member agreed that the workload was intense but countered, "[that] it is really nice on Mondays, when you are the tech in the main ED, and a patient rolls up from triage and you don't have to do as much".

Overall Project Results Summary

The results point to many benefits of RME. In the setting of a statistically significantly greater acuity within the 2016 sample, post-RME, there were no statistically significant differences in the overall ED LWBS rate, ED LOS by admission and discharge, and door to door disposition time by acuity with the exception of a statistically significant decrease in ESI level 5 routine patient encounters post-implementation of an ED RME when compared to pre-implementation data. The higher 2016 sample acuity was expected to have an increase in the LWBS rate, EDLOS by admission and discharge category and door to disposition time by acuity. Focus group results support findings that the RME is beneficial although they also noted areas for improvement in terms of workload and procedure development.

Additionally, the ED data on patients seen by a dedicated PIT had a statistically significant increase in the mean door to disposition of ESI level 4 less urgent patient encounters and an increase in the average ED LOS of admissions versus RME without a dedicated PIT. There was no statistically significant difference in LWBS rate, and in door to door disposition time for other acuities and in ED LOS of discharges. Focus group results also support these results as there were mixed preferences between working in the RME with or without a PIT, and not a strong concurrence. RME staff were able to identify beneficial RME scenarios to support

continuing the RME such as identifying sicker patients sooner, despite other opportunities for improvement.

Focus group sessions highlighted that there was increased stress in the RME versus pre-RME because of the increased workload, especially for the ED Techs. There was also stress from systems and processes that may occur with new interventions that include having to search for more equipment, or having to run to the back for medications. Additional focus group feedback included many opportunities for creation/enhanced policies and procedures, with the new abilities to initiate diagnostic interventions and treatments as needed.

Discussion

Discussion and Interpretation of Finding

The findings from this project, supported one of the hypothesis and disputed the other two hypotheses. With respect to hypothesis 1, in the setting of a statistically significantly greater sample acuity in 2016 post-RME, there were no statistically significant differences in the overall ED LWBS rate, ED LOS by admission and discharge, and door to door disposition time by acuity with the exception of a statistically significant decrease in ESI level 5 routine patient encounters post-implementation of an ED RME when compared to pre-implementation data. Hypothesis 2 was also disproven, the ED data on patients seen by a dedicated PIT had a statistically significant increase in the mean door to disposition of ESI level 4 less urgent patient encounters and an increase in the average ED LOS of admitted patients versus RME without a dedicated PIT. There was no statistically significant difference in LWBS rate, and in door to door disposition time for other acuities and in ED LOS of discharges. Conversely, hypothesis 3 was supported. Nursing and ED techs perceived a benefit to the patient for having an RME regardless of dedicated provider, although they had mixed feelings about other aspects of the

process. Nursing staff perceived that they were able to identify beneficial PIT scenarios to the patient identify issues sooner.

These results are informative and can direct future RME interventions, with or without PIT. The post-RME results in 2016 showed no statistically significant difference, except for a statistically significant reduction in ESI 5 routine patients ($p=0.037$), despite having higher acuity patients in 2016. This may suggest that a decrease in LWBS rates, door to disposition by acuity, or ED LOS by disposition category may have had a beneficial result if the patient samples were similar. It is possible that a greater effect is not seen with the limited spaces since higher acuity patients also may have longer evaluations which in turn allow for less people to be brought back to the main ED. Boarding more of these patients who have been admitted but not physically moved out of the ED compounds this issue. The statistically significant time reduction in ESI 5 routine patients could be reflective of the RME ability to directly discharge patients from the RME or the ability to be seen sooner. Focus group results also demonstrated that ED nurses and techs felt they were able to identify "sicker patients quicker" with the RME, and had even seen patients sent straight to the OR from the RME. Nurses felt empowered that they had the space to initiate treatment when there were no beds in the main ED to place a patient.

At this time, the findings surround PIT as compared to days with nursing protocols without a dedicated protocols are inconclusive. There was no statistically significant difference in LWBS rate, and in door to door disposition time, except ESL level 4, and in ED LOS of discharges. There may have been a significant decrease reflected in the LWBS rate if the electronic medical record would allow the PIT to sign up for patients seen in the RME and capture that a provider evaluation was done in the RME. If captured, LWBS patients would have been categorized as left without discharge reflecting a provider evaluation and the LWBS

rate of these patients would be decreased. This EMR improvement also may allow comparison of time to interventions, and of patients who arrived through RME compared more directly to those who did not. Patients seen by a dedicated PIT only had a statistically significant increase in the mean door to disposition of ESI level 4 less urgent patient encounters and an increase in the average ED LOS of admitted patients versus RME without a dedicated PIT. This could imply that nurse protocols on RME w/o PIT days are just as efficient as RME w/ PIT days, and possibly more efficient for ESI level 4 patients. This could also imply that care may have taken longer to be evaluated in the RME for ESI level 4 patient instead of being directly placed in express care. There were also 118 missing cases for the door to disposition times by acuity level which could have made a statistically significant difference, with 89 cases missing between ESI level 3 and ESI level 4, and 20 cases that had no acuity assigned. RME patients typically start interventions in ESI 3 and 4 with traditionally longer waits. There were mixed preferences between ED staff as to which intervention arm they preferred, with or without PIT. It was repeatedly stated by staff members that how efficient or successful the RME was run, both with and without a PIT, was largely determined by which individual was working. This project did not take that factor into consideration but overall effect. Many staff members felt RME without a dedicated PIT and nurse protocols only days, were less chaotic and more efficient, because staff knew what to expect. Some staff stated triage took longer. They also felt communication was more efficient on days without a dedicated provider. Although some communication barriers should be expected when initiating new interventions. However, the benefit of having a PIT is shown by the fact that multiple patients were discharged from the RME and even sent directly to the OR from RME. Nurses and ED staff initiated labs and had results return and sometimes treatments in the RME, even before a bed was available in the back. Having a PIT was also

beneficial as staff no longer had to track a provider down to review EKGs since the PIT would review them. Undoubtedly care was initiated prior to a bed space however there was also no statistically significant difference in mean door to disposition and between days with and without a dedicated PIT. This project compared four dedicated PIT days to four project days without a PIT with which a larger project period might have shown a greater effect. This information in conjunction with conflicting focus group information leads the researchers to determine that RME is beneficial but no recommendation could be made at this time in regards to PIT implementation.

In contrast, a recent systematic review and meta-analysis on a senior doctor in triage, (Abdulwahid, et al., 2016), demonstrated a pooled decreased effect in LWBS. There was also a reduction in LWBS, ED LOS, and wait times for many non-RCT studies but the meta-analysis findings did not support wide spread implementation as results could not be pooled due to heterogeneity of studies. These findings raise the point that perhaps, the RME with PIT results would differ if a more senior physician directed care in the PIT.

Although patients who required mental health evaluations were eliminated from this project in relation to ED crowding metrics however it was common practice for suicidal and homicidal patients to be kept in an RME bay when the one alternate location was taken. There were times in which multiple RME bays were occupied with suicidal, homicidal, and patients who required SAFE forensic assault examination. Patient who were either suicidal or homicidal would frequently occupy one or more than one RME bays after the department's "quiet room" was occupied. Reducing the number of bays could have impacted the efficiency of the RME as it reduces the number of functioning rooms used for triage/ diagnostic interventions. Suicidal and homicidal patients were never kept in the Pre-RME triage area since there was no physical space.

During this project period, the department was unable to track how long patients stayed in an RME bay but were initiating methods to record and report those metrics through the EMR in the future. This information would assist in determining how long patients were occupying bays but also allow the department to know how much sooner patients were getting interventions completed versus waiting for an ED Bed and also target opportunities for improvement.

The focus group feedback gave insight into opportunities for this ED to consider and address in revision or creation of RME procedures, including an ineffective EMR system to communicate RME actions. The focus groups highlighted sources of stress and distress in the RME. This project anticipated the possibilities of a few patient discharges but did not foresee that patients could be admitted or sent to the OR directly from the RME. Staff understood what was required of them if the patient was transitioning from the Main ED but the inability to dedicate that time conducting those functions in the ED led increased stress for RME staff. To reduce further reduce stress, ED nursing and tech staff also expressed a desire for RME medication and treatment scope clarifications. Ways to decompress the main ED would also decrease stress when they had “sick”, acuity level 2-3 patients that were not able to get a bed in a timely manner.

This project was successfully implemented in the ED and because of the strong support ED leadership, especially from the nurse manager to maintain consistent staffing despite staff shortages, ED physician leadership who identified department funds to monetarily support funding for a PIT, and support from the ED quality improvement coordinator with data during this project.

Setting aside statistical significance, the results of this evaluation deserve discussion. In the emergency department only a few minutes are needed to have eyes on and triage a patient

into the appropriate ESI category and therefore any increase or decrease is clinically significant. Given the increase in acuity and volume, is not surprising that there was an increase in door to disposition time noted post-RME for ESI 1-3. What is surprising, is that a larger increase was not seen. The statistically significant reduction of ESI 5 routine patients by over 58 minutes is clinically significant because this allows for more time that another patient could be evaluated, treated, and seen in the ED. Clinically the RME w/ PIT times were clinically significantly longer and therefore less efficient than RME w/o PIT days. This could suggest that it took longer for the PIT to evaluate patients which could delay triage for other patients arriving to the ED. However, this clinically significant delay does not automatically overrule the benefits of the PIT. The focus groups identified multiple instances in which the PIT had discharged patients or sent them to the OR from the RME and each these cases was of clinical benefit to these patients.

In conclusion, this quality improvement project demonstrated that there is overall benefit to the RME despite the lack of statistically significant differences on ED crowding metrics. When considering the larger volumes and higher patient acuity; even subtle changes in LWBS rates, door to disposition times by acuity and ED LOS by admission or discharge category are considered clinically significant. Post-RME results even door to disposition times for the ESI level 5 or routine patients ($p=0.037$). Qualitative findings in this project supported the overall benefit of the RME, despite mixed preferences between RME with PIT versus nurse protocols, desires for enhanced procedures, and reports of increased stress with the RME workload. RME with PIT had longer door to disposition times ($p=0.022$) than RME without PIT, for ESI level 4 less urgent patients and for overall ED LOS of admitted patients ($p=0.023$). This does not necessarily mean RME w/ PIT days are not beneficial as qualitative findings also noted that staff had experience that patients were discharged or sent directly to the OR on RME days with PIT. A

direct relationship between the RME and improved throughput in the ED could not be established, benefits of the RME are noted and additional investigation into RME with and without PIT after further process improvement.

Strengths and Limitations of the Design

Strengths of this project are that it evaluated a specific RME process model. This project reduced variations related to staffing and day of the week. It maintained consistent staffing of two RNs and two EMTs in the RME. This project utilized the use of a third-year ED resident under supervision of an emergency medicine attending physician, which is more cost effective than the studies reviewed in the literature with more experienced faculty or staff physicians. Using only third year residents eliminated variation in experience. This project also eliminated day variation by only conducting the project on Mondays. To our knowledge, previous studies have not been implemented in an American academic university rural safety net tertiary care hospital. Previous studies had universal healthcare insurance and did not incorporate the additional challenges faced with a rural and/or uninsured population.

This project also provided new qualitative information from the nursing and EMT staff experience with the RME/PIT intervention. The quantitative RME/PIT data combined with the qualitative focus group portion aided in a comprehensive evaluation.

Limitations of this project were that it did not evaluate additional days of the week due to staffing shortages. A larger implementation period could show greater effect. This project is limited in that it did not incorporate physician feedback within the focus groups, although less formal feedback was given to ED leadership, it was not incorporated into this project. This design would be more robust incorporating physician feedback in a more formal design. Results are not generalizable to other non-similar institutes but could contribute to knowledge of

alternative processes on how to implement an RME and the utilization of a PIT to combat LWBS rates. Limitation of the focus groups is that the themes collected are only a reflection of the nurses/EMTs that volunteered to participate. There is a possibility that non-work obligations did not allow certain individuals to participate, although staff input was collected for the best times to conduct focus groups to help to maximize participation.

Nursing Practice Implications

Knowledge gained from this project may be useful to other academic medical safety net hospitals when considering RME with/without a PIT to reduce LWBS rates. This project is unique in that it also gives insight to the ED nursing and tech staff experience. These insights can contribute to revisions and optimization of standard processes within the RME with/without a PIT. It will also inform this institute as it considers new practice patterns.

Implications for Future Studies and Development

This project and evaluation could be a jump off point for future studies and endeavors at this institution. Reevaluation of the RME with and without PIT could be of benefit after processes and policies have been refined. An alternate split flow process demonstrated in a recent study (Wiler, et al., 2016) published in the Joint Commission Journal on Quality and Patient Safety could be incorporated in future evaluations if the RME intent is changed from starting early diagnostic interventions to discharging lower acuity patients. The redesign decreased LWBS from 5.5% to 0.5%, and ED LOS for walk-in patients with a small effect size ($r=0.15$). The Wiler, et al., (2016) study used a registrar greeter plus ED tech to identify critical patients, bypass intake directly to the Main ED, and eliminate the traditional nursing triage method. The care design incorporated an attending physician intake team which included an emergency physician, scribe, and ED tech with intent to make quick final disposition decisions to

either discharge from intake with an internal waiting room, disposition to “super track” with care plan determined by the intake attending physician implemented by an advanced practice Nurse practitioner, or to the main ED with a physician resident team.

Future studies could also analyze the impact of different experience levels of providers with a dedicated PIT and or with difference experience of nursing staff without a PIT. In addition to LWBS, door to disposition by acuity, ED LOS admission and discharge, data could be collected that that looks specifically at how long processes take to triage or conduct interventions in the RME. By collecting this information, one could also discover how much sooner labs are initiated prior to be placed in the main ED. Future projects could also include PIT providers in the focus groups or further analyze patient satisfaction with the RME/PIT. This information could help to target gaps and develop ways to improve efficiency in the ED while under renovations.

Products of the DNP Capstone

RME program description with ED standard work protocol and/or RME algorithm is included. Results from this DNP capstone could influence future revisions of the RME and PIT. DNP project report will be uploaded into UVA Libra database. Abstract and poster submissions planned for national Emergency Nurses Association conference (13-16 September) and the National Association of Clinical Nurse Specialist 2018 annual spring conference at the completion of this project. Manuscript for publication will be produced for submission to *The Journal of Emergency Nursing* (see www.elsevier.com/locate/jen for author guidelines).

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Figures

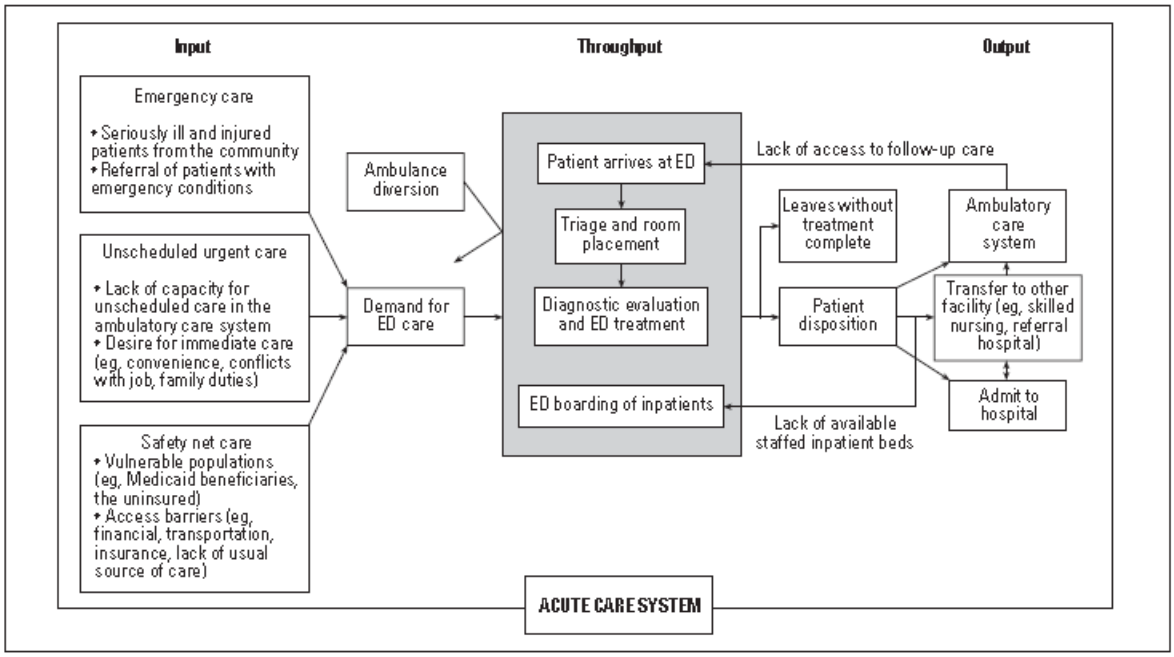


Figure 1. Input-Throughput-Output Conceptual Model of Emergency Department Crowding (Asplin, et.al, 2013).

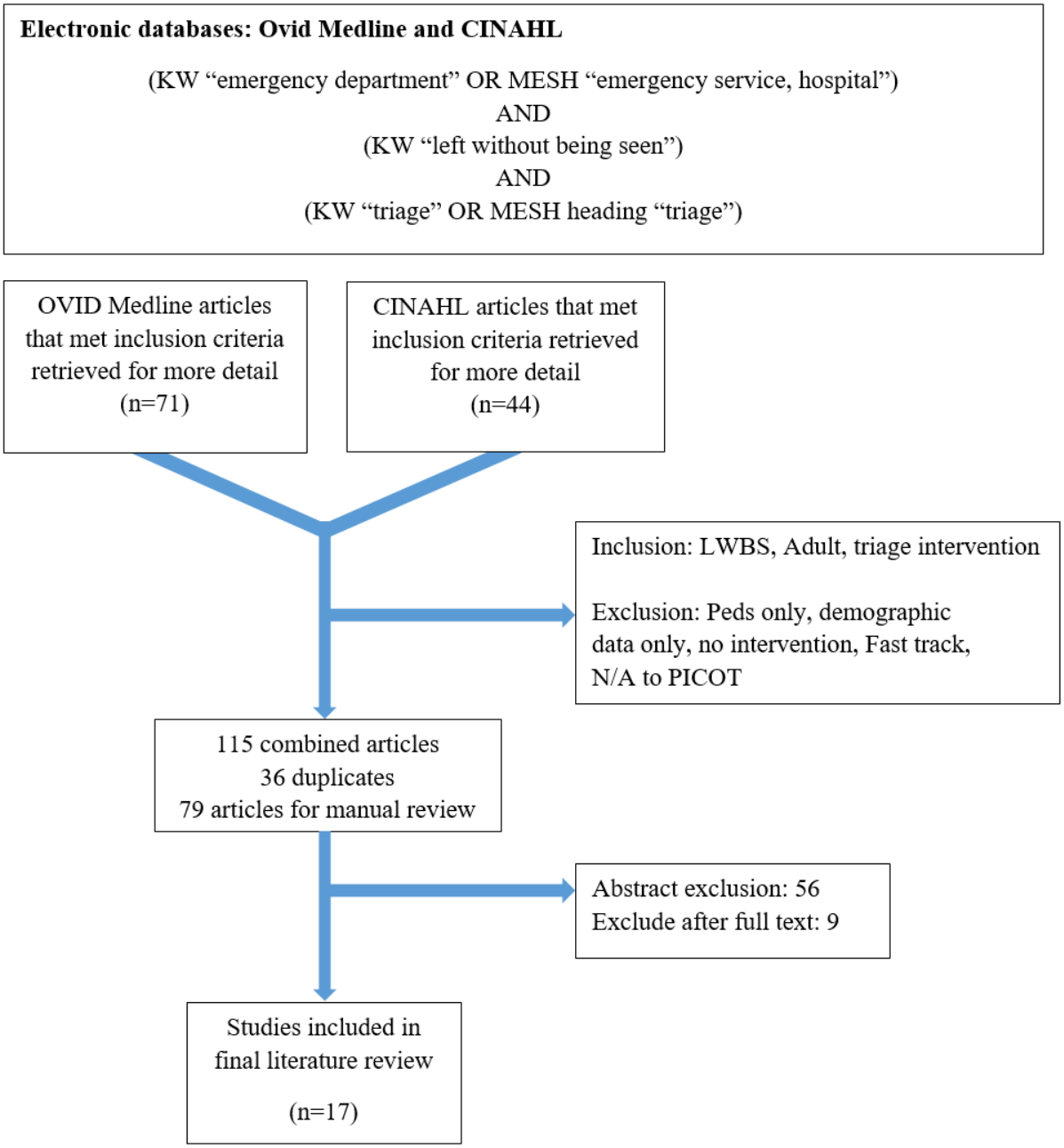


Figure 2. Methods Algorithm

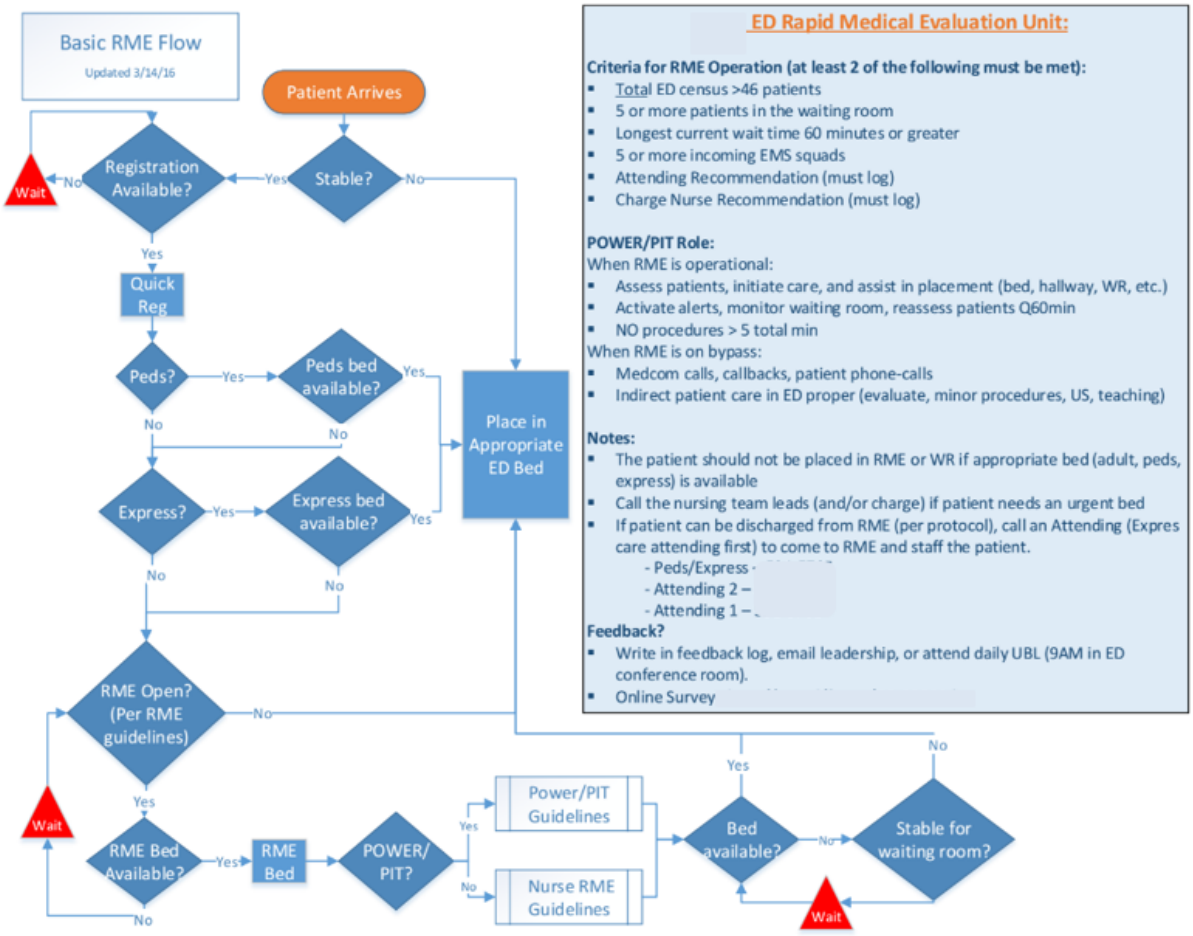


Figure 3. Rapid Medical Evaluation Algorithm and Operation Criteria (Nevel, A., 2016)

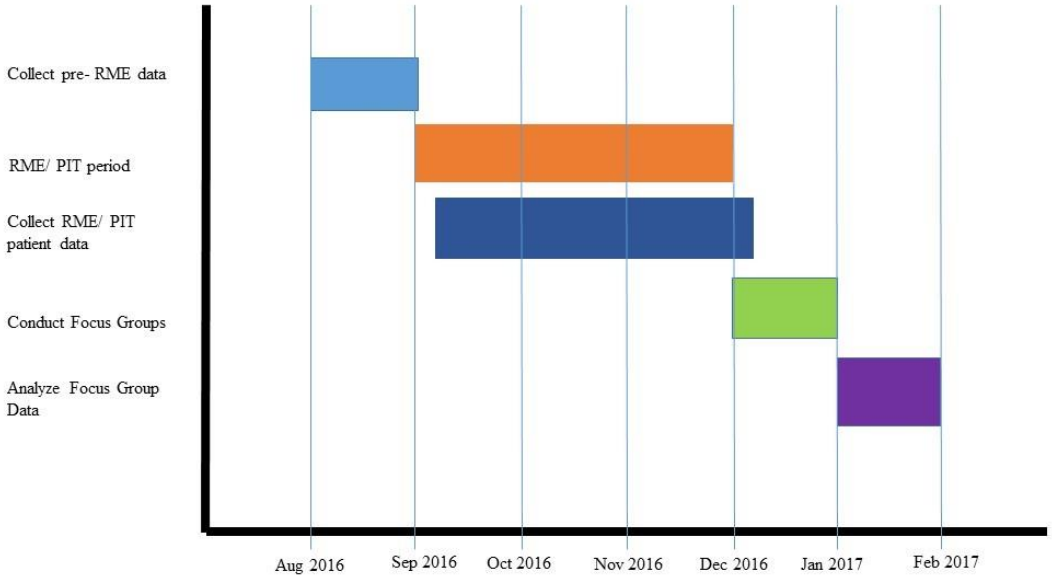


Figure 4. Evaluation of RME/PIT project timeline.

Tables

Table 1

Systematic Reviews of Triage Interventions Measuring Left without Being Seen

Author & Year	Purpose	Method	N	Outcomes
Bullard, et al. (2012)	Role of Rapid Assessment Zone on ED	Systematic Review	n=4 studies (2 measured LWBS)	Limited research to recommend implementation of a rapid assessment zone. Before and after study showed LWBS ↓ (RR=0.68; 95% CI: 0.63 to 0.73). 1 RCT LWBS *n.s.* difference. (RR=0.93; 95% CI 0.77 to 1.12)
Oredsson, et al. (2011)	Effect of triage interventions on patient flow parameters.	Systematic Review	n=33 (10 studies measured LWBS)	1 non-fast track streaming study with LWBS ↓ 2.3% to 1.6%. 4 studies including 1 RCT Team triage includes a physician with a relatively strong recommendation to LWBS ↓. Difference of 1.3%; 5 studies Fast Track effect LWBS ↓ difference 3.1% has moderately strong evidence.
Rowe, et al. (2011)	Role of triage liaison providers on ED crowding	Systematic Review	n= 28 studies (12 studies reported LWBS)	1 RCT and before and after designs. 1 RCT with *n.s.* LWBS but non RCTs did ↓ in LWBS; Authors stated that evidence may suggest use but weak research design requires more studies on provider efficiency before widespread implementation.

Note: ↑ is a statistically significant increase. ↓ is a statistically significant decrease. No statistically significant difference is annotated by *n.s.* $p < 0.05$ is significant.

Table 2

Literature Table of Left without Being Seen and Provider in Triage

Author & Year	Purpose	Method	N & Setting	Outcomes
Burlin-game (2009)	Effect of Midlevel provider in triage on LWBS, patient and staff satisfaction (perform Medical Screening Examination & ran fast track out of triage)	Before and after study (Doctoral Dissertation)	n= 892 Setting: Community ED 45,000pts; 12 bed ED and 9 minor care unit	LWBS ↓ Pt satisfaction ↑ and staff satisfaction= ↓10.0 to 8.3% LWBS; ↓10.9% to 5.6% specifically during intervention time.
Chan, et al. (2005)	Effect of REACT bundle on ED metrics (New IT registration, ED physician paged to initiate ancillary testing and interventions at triage when a ED bed was not available before completion of full registration)	Before and after study	n= 36522 Setting: Urban academic center ED 37,000 (85% ambulatory)	LWBS ↓ 7.7% to 4.4% ($p<.001$); Wait time ↓24 minutes; LOS ↓
Cheng, et al. (2013)	Effect of team triage on ED time metrics (Provider & additional RN in Triage MD/ RN supplementary team triage in 65 shifts (66 days as control))	Single blind cluster RCT	n= 17034 Setting: Non-US 45,000 22% admission	EDLOS =n.s. except for 4/5 acuity patients ↓LOS; 21% discharged from ED. Patient harm= n.s. 0 mortalities; 3 returned to ED within 48 hrs
DeFlitch, et al. (2015)	Describe Lean PDQ model and multiple interventions including physician in triage and LWBS/ Pt satisfaction	Case study	n= 104032 Setting: 39 bed ED at suburban, tertiary academic center, fast track observation area	LWBS Physicians managed 33-36% of patients; and Advanced Practice Providers 20-24%, LWBS reduced from 5.7% to 0.6% and door to provider improved by 62% to 20 min compared to last 12 months prior; door to bed was reduced by 91% to 19 min

Author & Year	Purpose	Method	N & Setting	Outcomes
				and average wait time to 12 min; Press Ganey satisfaction increased from 17th to 85Th percentile; MD paper stated need to compare the effectiveness of APCs and MDs. MD only paper
Han, et al. (2010)	Effect of additional physician in triage on ED metrics (Seven days a week from 1pm to 9 pm. Initiated diagnostic and evaluative treatment after triage nurse assignment)	Before and after study	n= 17265 Setting: medium size city 50,000	Significant ↓ in LWBS, ↓# in waiting room (WR), ↓WR LOS, ↓LOS of all patients, and non-admitted patients, *n.s.* change in admitted patients
Imperato, et al. (2012)	Effect of Team triage with daily attending physician randomly assigned in triage on ED crowding metrics (1300 to 2100hrs a day with additional RN and tech)	Before and after study	n= 17631 Setting: Community teaching hospital 36,000 with 23 bed and 10% admission with fast track.	LWBS decrease was not statistically significant. Used PIT terminology. Number of days on diversion ↓; registration to MD evaluation ↓.
Levsky, et al. (2008)	Effect of additional full-time TNT dedicated team of a physician, nurse, EMT to initiate treatment on ED crowding metrics. (M, T, TH, Sunday 1000-1800 for Urgent ESI 3 pts when no beds available in dedicated rooms and could also treat less urgent patients.)	Quasi-experimental	n= 78384 Setting: 65,000 military medical with 9,500 ESI 3 urgent patients	LWBS ↓ ($p<0.0001$); Time to be seen↓ 11%; LOS ↓ 23.2 min

Author & Year	Purpose	Method	N & Setting	Outcomes
Nestler, et al. (2014)	Evaluate physician assistant in triage on ED crowding metrics (resource neutral-eliminating fast track and moving to triage); (Partial diagnostics only blood and some x-rays. NO EKG or UA done triage.**)**	Before and after study	n= 1280 Setting: An academic tertiary care and level I trauma center 73,000 patients 30% admissions	LOS ↑ ESI level 4 and 5 on intervention days; Addition of personnel is beneficial and not just movement of personnel. (Blood and some x-rays, NO EKG or UA done in triage as no place to undress) patient) PA only
Ng, et. al (2010)	Compare ED metrics before and after Lean® consultant in ED start in 2005; (Reduce waste; multiple avenues to improve layout of ED, creation of standard work; Triage nurse also sort patients to discharge/ admit)	Before and after study	n= 820 Settings: Canadian regional specialty referral center with a fast track serving 55,000	LWBS patients' ↓ from 7.1 to 4.3%, decreased mean was 3.6 to 2.8 hours with largest decrease with fast track. Discussion: 86% sensitivity of nurse to predict discharge. 1/7 patients were uncertain. Mean registration to MD ↓ from 111 to 78.
Partovi, et al. (2001)	Effect of team triage on ED crowding metrics. (Faculty triage in addition to 2 nurses plus 1 tech standard which is to order extremity x-rays, no lab protocols, 16 consecutive Mondays from 9am to 9pm, discharge/ order hydration)	Quasi-experimental	n= 1734 Setting: Urban county teaching hospital 29 bed Level II 52,000 pts; 16% admitted; ED with dedicated lab and x-ray/ urgent care was available	Faculty triage reduced LOS by a mean of 82 minutes (p= 0.005) for both admitted and discharged patients. Patients with x-rays had shorter LOS than those without.
Preyde, et. al (2012)	Compare ED metrics before Lean® bundle interventions	Before and after study	n= 726 Setting: Canadian regional community ED with 45,000 pts	Lean interventions associated with ↓ LWBS and wait times ↓. Discussion: Patient ↓ Perceptions in time, overall satisfaction ↑, 3.17 to 3.4 out of 4 ($p < 0.001$), ↓ LOS except for acuity 1 patients.

Author & Year	Purpose	Method	N & Setting	Outcomes
Soremekum, et al. (2014)	Evaluate effect of streaming ESI 3 on LOS and LWBS. (Dedicated Mid track area focusing on Urgent ESI 3 with existing Attending and additional 2 RNs; 3.4% manpower increase. MD reviewed triage note and pulled medium acuity patient with high likelihood of going home, after normal triage process.)	Before and after study	n= 91903 Setting: hospital	Mid track significantly ↓overall LWBS (p <0.0001) from 6.85 to 4.46% despite increased volumes. For high acuity patients the LOS ↑ by 24 minutes. Mean LOS ↓ decreased for ESI 3 pts; n.s. change in lower acuity LOS despite using traditional fast track space.
Traub, et al. (2015)	Evaluate effect Rapid Medical Assessment with additional Triage team on ED crowding metrics **(**Additional MD/ RN team stationed next to triage room and triage nurse, focused assessment, place into bed or discharge if eval completed. Meds were non-narcotic or zofran. RMA M & F 1000-2300 largest volume. No "fast track" area.)	Before and after observational study	n= 2919 **Setting:** 24 bed suburban tertiary care teaching hospital 24,500 pts 30% admissions	RMA ↓ LOS (p. <0.0001) at approximately 36 min at a system level but n.s. for LWBS; **Discussion:** Lack of congruence between physicians. Possible ↑ LOS for group 2 who had order at RMA and then in main ED repeated/ additional labs wanted either for insufficient/ required new knowledge.
Xi, & Dalal. (2015)	Effect of Family medicine resident on ED crowding metrics (Family resident physician utilized as there were no Emergency residents)	Before and after observational study	n= 21141 **Setting:** ED 21,141 patients	Resident intervention was associated with ↓ LWBS 2.8% vs 4.9%, 12 min off of total ↓ LOS; n.s. left without being treated

Note: Rapid Entry and Accelerated Care at Triage (REACT) is an intervention to speed up

registration, triage, placement, & ancillary testing with high bed census. $p < 0.05$ is significant. ↑ is a statistically significant increase. ↓ is a statistically significant decrease. No statistically significant difference is annotated by *n.s.*

Table 3

Pre and Post-RME[*] Sample Description

Intervention	**Pre-RME**	**Pre-RME**	**Post-RME**	**Post-RME**	**t-test**	**Sig.**
Category	n	Mean	n	Mean		
Age[a]	1417	41.40	1469	41.73	0.699	n.s.
Intervention/Year N=2886	**Pre-RME 2015**	**Pre-RME 2015**	**Post-RME 2016**	**Post-RME 2016**	**Pearson's Chi square (Asymptomatic significance 2 sided)**	**Sig.**
Gender	n	Percent	n	Percent		
Male	686	48.4	667	45.4		
Female	731	51.6	802	54.6		
Total	1417	100.0	1469	100.0	0.106	n.s.
Race						
White	934	66.0	958	65.3		
Black	411	29.0	412	28.1		
Asian	6	0.4	17	1.2		
Other	64	4.5	80	5.5		
Missing	2	0.1	2	0.1		
Total	1417	100.0	1469	100.0	0.093	n.s.
Ethnicity						
Non-Hispanic	1327	93.8	1372	93.7		
Hispanic	87	6.2	93	6.3		
Missing cases						
Total w/ missing cases	1417	100.0	1469	100.0	0.829	n.s.
Payor						
Self Pay	321	22.7	275	18.7		
Medicare	306	21.6	308	21.0		
Medicaid	261	18.4	232	15.8		
Military Ins[b]	17	1.2	10	0.7		
Private Ins	376	26.7	335	22.8		
Other	5	0.4	7	0.5		
Unknown	128	9.0	302	20.6		
Total	1417	100.0	1469	100.0	**0.000**	**sig**

[*]Rapid Medical Evaluation (RME). [a]Age in years. [b]Insurance.

Note: There were less people who were self pay and Medicaid, and large percentage unknown than expected post-RME than pre- RME. $p < 0.05$ is significant.

Table 4

Pre and Post-RME[*] Sample Acuity and Disposition

Intervention N=2886	**Pre-RME**	**Pre-RME**	**Post-RME**	**Post-RME**	**Pearson's Chi square (Asymptomatic significance 2 sided)**	**Sig.**
Acuity[a]	n	Percent	n	Percent		
Null Acuity	29	2.0	25	1.7		
ESI 1	6	0.4	5	0.3		
ESI 2	178	12.6	222	15.1		
ESI 3	804	56.7	864	58.8		
ESI 4	353	24.9	325	22.1		
ESI 5	47	3.3	28	1.9		
Missing cases	0	0.0	0	0.0		
Total w/ missing cases	1417	100.0	1469	100.0	**0.029**	**sig**
Disposition						
LWBS[b]	80	5.6	79	5.4		
Admission	352	24.8	381	25.9		
Discharge	960	67.7	975	66.4		
Other	24	1.7	29	2.0		
Deceased	1	0.1	1	0.1		
Null Disposition	0	0.0	4	0.3		
Total	1417	100.0	1469	100.0	0.585	n.s.

[*]Rapid Medical Evaluation (RME). [a]Acuity defined by Emergency Severity Index (ESI) level used in triage. The most emergent patient requiring lifesaving measures is ESI 1 and the lowest resourced routine patient is ESI 5. [b]Left without being seen (LWBS). $p < 0.05$ is significant.
Note: 2016 had more ESI 2-3, Less ESI 4-5. With statistically significantly higher acuity, the LWBS rate decreased but statistically was the same.

Table 5

Mean Times Pre and Post-RME[*] sample

Intervention	**Pre-RME**	**Pre-RME**	**Post-RME**	**Post-RME**	**Missing analysis**			
Acuity[a]	n	Mean (h:mm:ss)	n	Mean (h:mm:ss)	Number of cases	Mean Difference	t test	
Null Acuity	9	2:55:53	5	2:00:48	40	-0:55:05	0.245	n.s.
ESI 1	5	1:14:00	4	1:40:45	2	+0:26:45	0.298	n.s.
ESI 2	173	3:36:16	219	4:03:00	8	+0:26:44	0.079	n.s.
ESI 3	765	4:46:10	800	4:52:07	103	+0:05:57	0.474	n.s.
ESI 4	323	3:11:18	300	2:57:28	55	-0:13:50	0.125	n.s.
ESI 5	36	2:59:23	23	2:00:42	16	-0:58:42	**0.037**	**sig**
Missing cases	106		118		N/A			
Total w/ missing cases	1417		1469					
Disposition Category EDLOS[b]								
Admissions	352	8:09:00	380	7:56:00	1	+0:12:00	0.515	n.s.
Discharges	960	4:32:00	975	4:36:00	0	+0:03:00	0.649	n.s.
Total	1312		1355					

[*]Rapid Medical Evaluation (RME). [a]Acuity defined by Emergency Severity Index (ESI) level used in triage. The most emergent patient requiring lifesaving measures is ESI 1 and the lowest resourced routine patient is ESI 5. [b]Emergency Department Length of Stay (ED LOS). $p < 0.05$ is significant.

Table 6

Demographic Data on RME[*] without PIT[**] versus RME with PIT

Intervention	**RME w/o PIT**	**RME w/o PIT**	**RME with PIT**	**RME with PIT**	**t-test**	**Sig.**
Category	n	Mean	n	Mean		
Age[a]	755	41.06	714	42.44	0.275	n.s.
Intervention/Year	**RME w/o PIT**	**RME w/o PIT**	**RME with PIT**	**RME with PIT**	**Pearson's Chi square (Asymptomatic significance 2 sided)**	**Sig.**
Patients	n	Percent	n	Percent		
2016 RME	755	51.4	714	48.6		
Gender						
Male	332	44.0	335	46.9		
Female	423	56.0	379	53.1		
Total	755	100.0	714	100.0	0.257	n.s.
Race						
White	495	65.6	463	64.9		
Black	212	28.1	200	28.1		
Asian	9	1.2	8	1.1		
Other	38	5.0	42	5.9		
Missing	1	0.1	1	0.1		
Total	755	100.0	714	100.0	0.322	n.s.
Ethnicity						
Non-Hispanic	710	94.0	662	92.8		
Hispanic	42	5.6	51	7.2		
Missing cases	3	0.4	1	0.1		
Total w/ missing cases	755	100.0	714	100.0	0.453	n.s.
Payor						
Self Pay	122	16.2	153	21.4		
Medicare	143	18.9	165	23.1		
Medicaid	108	14.3	124	17.4		
Military Ins[b]	5	0.7	5	0.7		
Private Ins	151	20.0	184	25.8		
Other	32	0.4	4	0.6		
Unknown	223	29.5	79	11.1		
Total cases	755	100.0	714	100.0	**0.000**	**Sig.**

[*]Rapid Medical Evaluation (RME). [**]Provider in Triage (PIT). [a]Age in years. [b]Insurance. $p < 0.05$ is significant.

Table 7

Acuity and Disposition of *RME[*] without PIT[**] versus RME with PIT*

Intervention	**RME w/o PIT**	**RME w/o PIT**	**RME with PIT**	**RME with PIT**	**Pearson's Chi square (Asymptomatic significance 2 sided)**	**Sig.**
Acuity[a]	n	Percent	n	Percent		
Null Acuity	11	1.5	14	2.0		
ESI 1	3	0.4	2	0.3		
ESI 2	120	15.9	102	14.3		
ESI 3	440	58.3	424	59.4		
ESI 4	165	21.9	160	22.4		
ESI 5	16	2.1	12	1.7		
Missing cases	0	0.0	0	0.0		
Total w/ missing cases	755	100.0	714	100.0	0.873	n.s.
Disposition						
LWBS[b]	40	5.3	39	5.5		
Admission	205	27.2	176	24.6		
Discharge	491	65.0	484	67.8		
Other	16	2.1	13	1.8		
Deceased	1	0.1	0	0.0		
Null Disposition[c]	2	0.3	2	0.3		
Total w/ missing cases	755	100.0	714	100.0	0.482	n.s.

[*]Rapid Medical Evaluation (RME). [**]Provider in Triage (PIT). [a]Acuity defined by Emergency Severity Index (ESI) level used in triage. The most emergent patient requiring lifesaving measures is ESI 1 and the lowest resourced routine patient is ESI 5. [b]Left without being seen (LWBS). [c]No disposition category was listed. $p < 0.05$ is significant.

Table 8

Mean times of RME without PIT** versus RME with PIT*

Intervention	**RME w/o PIT**	**RME w/o PIT**	**RME with PIT**	**RME with PIT**	**Missing analysis**			
Acuity[a]	n	Mean (h:mm:ss)	n	Mean (h:mm:ss)	Number of cases	Mean Difference	t test	
Null Acuity	3	2:21:20	2	1:30:00	20	-0:51:20	0.584	n.s.
ESI 1	3	1:56:40	1	0:53:00	1	-1:03:40	0.263	n.s.
ESI 2	118	4:00:09	101	4:06:18	3	+0:06:09	0.757	n.s.
ESI 3	404	4:44:19	396	5:00:05	64	+0:15:45	0.157	n.s.
ESI 4	153	2:43:41	147	3:11:49	25	+0:28:09	**0.022**	**sig**
ESI 5	12	1:44:35	11	2:18:16	5	+0:33:41	0.228	n.s.
Missing cases	62		56		118			
Total w/ missing cases	755		714					
Disposition ED LOS[b]								
Admission	205	7:32:00	175	8:25:00	1	+0:53:00	**0.023**	**sig**
ED LOS Discharges	491	4:26:00	484	4:46	0	+0:20:00	0.052	n.s
Total	696		659					

*Rapid Medical Evaluation (RME). **Provider in Triage (PIT). [a]Acuity defined by Emergency Severity Index (ESI) level used in triage. The most emergent patient requiring lifesaving measures is ESI 1 and the lowest resourced routine patient is ESI 5. [b]Emergency Department Length of Stay (ED LOS). $p < 0.05$ is significant.

Appendix A

Focus Group Informed Consent Agreement

Project Title: Staff Perceptions of ED Rapid Medical Evaluation/ Physician in Triage Models

Please read this consent agreement carefully before you decide to participate in the study.

Purpose of the research study: The purpose of the study is to understand emergency department (ED) nurse and ED Tech perceptions of the Rapid Medical Evaluation (RME) area and the Physician in Triage (PIT) models.

What you will do in the study: If you decide to participate in this study, you will join semi-structured focus groups with other ED RNs and ED Techs. You will be asked pre-developed questions to facilitate the discussion. Notes will be taken during the discussions by graduate researchers who are not employed by University of Virginia ED to capture the dialogue. No names will be written. The primary goal is to capture topic themes and impressions.

You will also be asked to complete a basic demographic information sheet including information such age, gender and years of nursing experience. Your name will not be on the demographic sheet.

You are asked to voluntarily participate in the discussion points that you are comfortable speaking about. You are invited to speak freely. You do not need to discuss anything that you do not want to share. You many leave the room at any time. You are not obligated to participate.

The focus group information will assist in evaluating the current RME/PIT structures and in guiding future development of pertinent standard work.

Time required: The study will require about one hour of your time.

Risks: There is a small risk of a confidentiality breach. To minimize the risks the researchers will not write any names in relation to the dialogue or the demographic data sheet. In some cases it may not be possible to guarantee confidentiality. We cannot guarantee your data will be confidential and it may be possible that others will know what you have reported. However, the researchers will request that everyone who participates in the focus group maintains confidentiality outside of the room.

Benefits: There are no direct benefits to you for participating in this research study. The study may help us understand how to improve or standardize work in the RME and how to best utilize a PIT.

Confidentiality: The information that you give in the study will be handled confidentially. Focus group data sheets will only be reviewed by student team members, none of whom are

UVA ED employees or supervisors. The data sheets will be locked in a locked file drawer in the School of Nursing, and will not be shared with unit leadership. Only de-identified compiled data will be shared upon completion of this project. Themes and impressions may be published by study personnel. The information that you provide during the study will be handled confidentially. When the study is completed and the data have been analyzed, the notes from the dialogue will be shredded and destroyed. Your name will not be used in any report.

Because of the nature of focus groups, we cannot guarantee your data will be confidential and the other focus group participants would be aware of who participated and the content. We ask that none of the members share information outside of the group to maintain confidentiality. If you feel uncomfortable speaking in a group setting and or have additional feedback to provide, please notify the researcher so that we can accommodate and gain your full perspective.

Voluntary participation: Your participation in the study is completely voluntary. Your employment will not be effected by participation in the study.

Right to withdraw from the study: You have the right to withdraw from the study at any time without penalty. Demographic information on paper will be returned to the person withdrawing if they have not been collected.

How to withdraw from the study: If you want to withdraw from the study, please tell the researcher and then leave the room. There is no penalty for withdrawing.

Payment: You will receive no payment for participating in the study.

This is a single-site study at the University of Virginia (UVA) Medical Center.

If you have questions about the study, contact:
Primary Investigator: Monique Jesionowski, MSN, RN, CMSRN
School of Nursing, Box 800135/McKim Hall
University of Virginia, Charlottesville, VA 22903.
Telephone: (732) 610-5543
msj5dd@virginia.edu

Faculty Advisor: Beth D. Quatrara DNP, RN, CMSRN, ACNS-BC
School of Nursing, Box 800135/McKim Hall
University of Virginia, Charlottesville, VA 22903.
Telephone: (434) 924-5392
BAD3E@virginia.edu

If you have questions about your rights in the study, contact:
Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 500

University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: www.virginia.edu/vpr/irb/sbs

Agreement:
Please ask questions about any part of this consent that is not clear to you. By verbal agreement, I agree to participate in the research study described above. **By remaining in the room once interview questions have been asked, consents that you have received this information and all your questions have been answered. You may choose to not answer any question and to leave the room at any time.**

Thank you for your consideration. Your feedback is very important.

You may keep this form for your records.

Appendix B

Focus Group Email Recruitment

Seeking RN and ED Tech Perceptions on the use of RME/Providers in Triage

In addition to the numbers, we are conducting voluntary focus groups with Nurses and ED techs on the following dates and times in:

1. Monday, Dec 12, 2016 10:00 AM– 11:00 AM – Radiology Conf. Room A&B Reserved

2. Tuesday, Dec 13, 2016 7:30 PM- 8:30 PM – Moss Auditorium

(directly across from West elevators)

3. Wednesday, Dec 14, 2016 7:30 PM- 8:30 PM – Moss Auditorium

ADDITIONAL Dates: If none of the above dates work, please contact the PI and one additional session below could be arranged based on interest

4. Monday, Dec 12, 2016 7:30 PM- 8:30 PM – Moss Auditorium

5. Wednesday, Dec 14, 2016 10:00 AM– 11:00 AM – Moss Auditorium

The purpose of this research study is to understand the Nurse and ED tech experience with the Physician in Triage models including perceived benefits and areas of improvement. If you decide to participate, the study will involve up to one hour of your time. Your comments will be confidential. They will not be shared outside of the focus group. There is no direct compensation but light snacks/food will be provided during the focus group meeting. You do not have to be in this study if you do not want to participate. Your decision to be in any study is totally voluntary. Your employment at UVA will not be altered by your decision to participate or not participate.

• Review the attached consent form and call the numbers below so that a researcher can talk with you about the study and answer your questions.

If you are interested in learning more about the study or to register for a focus group session, please contact the PI, Monique Jesionowski, at msj5dd@hscmail.mcc.virginia.edu 732-610-5543.

Thank you for your time,

Monique Jesionowski, MSN, RN, ACCNS-AG, CMSRN

Doctorate in Nursing Practice Student, University of Virginia School of Nursing

Principal Investigator: Monique Jesionowski, MSN, RN, ACCNS-AG, CMSRN

Study Title: Staff Perceptions of ED Rapid Medical Evaluation/Physician in Triage Models IRB-SBS #: 2016-0471-00

Appendix C

Focus Group Demographic Information

Age: (Fill in the blank) _____

Gender: (Circle answer below)

Female Male Other

Race/Ethnicity: (Circle all that apply)

White Black or African American American Indian or Alaska Native

Asian Native Hawaiian or Other Pacific Islander Hispanic

Number of years as a Nurse or ED Tech: _____

Number of years working in an emergency department as a Nurse or ED tech: _____

Have you worked in the RME with a dedicated Provider in Triage and or have you received a patient that had orders completed in the RME prior to assignment of the patient in the main ED?

Yes No Unsure

Appendix D

Capstone Project Approvals

UNIVERSITY of VIRGINIA IRB-HSR

Institutional Review Board for Health Sciences Research

ROUTING FORM

IRB-HSR#: 19292 **OR** **Submission #** _____ **Submission Date:** SEP 19 2016

The IRB-HSR cannot process this request without one of these numbers.

Complete this form and attach it to the top of ALL submissions to the IRB-HSR Office.

Which IRB staff member did you work with on the pre-review of this submission? Ms. Margaret Ball

IMPORTANT: If multiple documents are submitted, they must be submitted with a Document Submission Form.
You are encouraged to submit all large documents (e.g. sponsor's protocols, investigators brochures) on a CD. They must be in PDF format. The IRB # and Submission Date of the CD must be written directly on the CD.
A Document Submission Form must be submitted with the CD.

If another IRB is the IRB of record for this protocol, check an IRB below:
- ☐ NCI CIRB (NCI Cooperative Group protocols)
- ☐ NeuroNEXT CIRB (NeuroNEXT protocols)
- ☐ Fred Hutchinson CIRB (CITN protocols)
- ☐ Western IRB-(NCI Cooperative Group)
- ☐ Other: *Name* _____

For IRB- HSR office use only
Receipt Date: SEP 26 2016

Type of Submission:
- ☐ New Grant
- ☐ New Protocol-Exempt/ Coded/ Not Engaged
- ☒ New Protocol Expedited
- ☐ New Protocol- Full Board
- ☐ Follow up to Requests from Full Board Review of: ☐ New Protocol ☐ Modification
- ☐ Modification - Attach Appropriate Modification Forms : ☐ Personnel Change
- ☐ Adverse Event Report
- ☐ Advertisement
- ☐ Protocol Violation/Enrollment Exception
- ☐ Status Report
- ☐ Study Closure
- ☐ Other, *Specify*: _____
- ☐ IND/IDE Annual Report
- ☐ Revised Investigator Brochure

Check one item below
- ☐ No changes required to protocol or consent
- ☐ Changes required to protocol or consent (attach Modification Request Form and revised protocol and or consent)

CONTACT INFORMATION
Provide contact information for a representative who can answer any questions the IRB might have concerning this submission:
Approvals/receipt of acknowledgments will also be sent to the person listed below.

Contact Name: Monique Jesionowski / Beth Quatrara Phone Number: 732-610-5543

E-Mail Address: msj5dd@virginia.edu Messenger Mail Box #: 800135

Select how you would like the IRB to send the approval/receipt of acknowledgment to you.
- ☒ Return reply in messenger mail
- ☐ I will pick up reply at Davis 5- Room 5293 Pick up Box
- ☐ I will pick up reply from Morton Drive

Replies not picked up within 5 week days will be sent to the contact via Messenger Mail.
The IRB-HSR is unable to send approvals via regular mail unless the individual is not physically located at UVa.
Comments:

UNIVERSITY *of* VIRGINIA

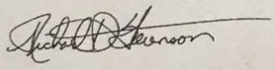
Office of the Vice President for Research
Institutional Review Board for Health Sciences Research

Confirmation of Training in Human Subject Protection

HSR # : 19292 **Title :** Pre and Post Comparison of a Rapid Medical Evaluation and Provider in Triage Models on Emergency Department Left without Being Seen Rates

This is a certificate confirming that the following personnel have completed University of Virginia Research Training, an on-line tutorial that reviews the core concepts for the responsible conduct of research in a way that is consistent with federal and university requirements. Following each topic summary, the investigator must correctly answer the test question before being allowed to continue. This training is required every three years.

Name	Training	Last Trained	Expires
Beth Ann D Quatrara	HSR (HSR CITI - All Researchers)	29-Dec-13	29-Dec-16
John P Riordan	HSR (HSR CITI - Update)	11-May-15	11-May-18
Monique S Jesionowski	HSR (HSR CITI - All Researchers)	17-Jan-15	17-Jan-18



10/03/2016

Richard Stevenson, MD
Chair, Institutional Review Board for Health Sciences Research
(UVA IRB)

Date

One Morton Drive, Suite 400 ▪ P.O. Box 800483 ▪ Charlottesville, VA 22908-0483
434-924-2620 ▪ Fax: 434-924-2932
www.virginia.edu/vprgs/irb/

University of Virginia
Institutional Review Board for Health Sciences Research
HIPAA Privacy Board

IRB - HSR # 19292		
Event: Approval New Protocol - Expedited	**Type:** Protocol	**Sponsor(s):** **Sponsor Protocol #:** **Principal Investigator:** Beth Ann Quatrara, DNP, RN, CMSRN, ACNS-BC
Title: Pre and Post Comparison of a Rapid Medical Evaluation and Provider in Triage Models on Emergency Department Left without Being Seen Rates		
Assurance: Federal Wide Assurance (FWA)#: 00006183		
Certification of IRB Review: The IRB-HSR/HIPAA Privacy Board abides by 21CFR50, 21CFR56, 45CFR46, 45CFR160, 45CFR164, 32CFR219 and ICH guidelines. This activity has been reviewed in accordance with these regulations.		
Event Date: 3 October 2016 **Protocol Expiration Date:** 2 October 2017 **Number of Subjects:** 2720 **HSR Protocol Version Date:** 19 September 2016 **Data Security Plan Date:** 19 September 2016		
Current Status: Open to enrollment		
Consent Version Dates:		
Committee Members (did not vote):		
Comments: The IRB determined the protocol met the criteria for approval per the federal regulations and was approved. It is open to enrollment. The purpose of this record review is to evaluate the effectiveness of a recently implemented staffing model in the triage area of the emergency department. There is no outside sponsor for this study. N= 2720 subjects Ages: any No additional committee approvals are required. No compensation. ---------- REGULATORY INFORMATION: The IRB determined this protocol met the criteria of minimal risk.		

Protocol Expedited by Category #5: Research involving materials (data, documents, records or specimens) that have been collected solely for non-research purposes (such as medical treatment and/or diagnosis).

This protocol has been granted a Waiver of Consent to identify potential subjects via 45CFR46.116.

This protocol has been granted a waiver of consent under 45CFR46.116 for the main study.

This protocol has been granted a waiver of HIPAA authorization under 45CFR 164.512(i)(2) for the main study.

The following HIPAA identifiers will be collected: all elements of dates, medical record number.

The minimum necessary PHI to be collected includes: demographics, admission complaint, discharge diagnosis, ESI acuity level, payor information.

Subjects may not be contacted by any method (email, phone, in person etc.) to obtain more information for this study without additional IRB-HSR approval.

No identifiable health information will be taken or shared outside of the UVa HIPAA covered entity.

PLEASE REMEMBER:
* If an outside sponsor is providing funding or supplies, you must contact the SOM Grants and Contracts Office/ OSP regarding the need for a contract and letter of indemnification. If it is determined that either of these documents is required, participants cannot be enrolled until these documents are complete.
* You must notify the IRB of any new personnel working on the protocol PRIOR to them beginning work.
* You must obtain IRB approval prior to implementing any changes to the approved protocol or consent form except in an emergency, if necessary to safeguard the well-being of currently enrolled subjects.
* If you are obtaining consent from subjects, prisoners are not allowed to be enrolled in this study unless the IRB-HSR previously approved the enrollment of prisoners. If one of your subjects becomes a prisoner after they are enrolled in the protocol you must notify the IRB immediately.
* You must notify the IRB-HSR office within 30 days of the closure of this study.
* Continuation of this study past the expiration date requires re-approval by the IRB-HSR.

The IRB-HSR official noted below certifies that the information provided above is correct and that, as required, future reviews will be performed and certification will be provided.

Name: Margaret W. Ball, BSN, MEd, CIP **Title:** Member, Institutional Review Board for Health Sciences Research **Phone:** 434-924-9634 **Fax:** 434-924-2932	**Name and Address of Institution:** Institutional Review Board for Health Sciences Research PO Box 800483 University of Virginia Charlottesville, VA 22908
Approval: **Approved by** Margaret W. Ball, BSN, MEd, CIP **From IP Address: 128.143.219.196**	**Date:** 3 October 2016 at 04:22 PM

University of Virginia
Institutional Review Board for Health Sciences Research
HIPAA Privacy Board

IRB - HSR # 19292		
Event: Approval Protocol Modification - Expedited	**Type:** Protocol	**Sponsor(s):** **Sponsor Protocol #:** **Principal Investigator:** Beth Ann Quatrara, DNP, RN, CMSRN, ACNS-BC
Title: Pre and Post Comparison of a Rapid Medical Evaluation and Provider in Triage Models on Emergency Department Left without Being Seen Rates		
Assurance: Federal Wide Assurance (FWA)#: 00006183		
Certification of IRB Review: The IRB-HSR/HIPAA Privacy Board abides by 21CFR50, 21CFR56, 45CFR46, 45CFR160, 45CFR164, 32CFR219 and ICH guidelines as compatible with FDA and DHHS regulations. This activity has been reviewed in accordance with these regulations.		
Event Date: 04/24/17 **Protocol Expiration Date:** 10/02/17 **Number of Subjects:** 2996 **HSR Protocol Version Date:** 04/18/17 **Data Security Plan Date:** 09/19/16		
Current Status: Open to enrollment		
Consent Version Dates:		
Committee Members (did not vote):		
Comments: The IRB determined the modification met the criteria for approval per the federal regulations and was approved. Modification expedited: minimal risk/minor changes. The revised IRB protocol included the following key changes: 1) Increased enrollment at UVA FROM 2720 TO 2996. Enrollment change form is on file. This study was previously granted waiver of consent for the main study, there is no consent to be revised.		
The IRB-HSR official noted below certifies that the information provided above is correct and that, as required, future reviews will be performed and certification will be provided.		
Name: Hein T. Ng, PhD **Title:** Member, Institutional Review Board for Health Sciences Research **Phone:** 434-924-9634 **Fax:** 434-924-2932		**Name and Address of Institution:** Institutional Review Board for Health Sciences Research PO Box 800483 University of Virginia Charlottesville, VA 22908
Approval: **Approved by** Hein T. Ng, PhD **From IP Address: 128.143.219.173**		**Date:** 04/24/17 at 08:04 AM

UNIVERSITY of VIRGINIA

OFFICE OF THE VICE PRESIDENT FOR RESEARCH
INSTITUTIONAL REVIEW BOARD FOR THE SOCIAL AND BEHAVIORAL SCIENCES

In reply, please refer to: Project # 2016-0471-00

December 7, 2016

Monique Jesionowski
Beth Ann Quatrara
Graduate Program
PO Box 800135
c/o Beth Quatrara

Dear Monique Jesionowski and Beth Ann Quatrara:

The Institutional Review Board for the Social and Behavioral Sciences has approved your research project entitled "Staff Perceptions of ED Rapid Medical Evaluation/Physician in Triage Models." You may proceed with this study. The unsigned Focus Group Informed Consent has been approved for use with participants.

This project # 2016-0471-00 has been approved for the period December 7, 2016 to December 6, 2017. If the study continues beyond the approval period, you will need to submit a continuation request to the Review Board. If you make changes in the study, you will need to notify the Board of the changes.

Sincerely,

Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences

One Morton Drive, Suite 500 • Charlottesville, VA 22903
P.O. Box 800392 • Charlottesville, VA 22908-0392
Phone: 434-924-5999 • Fax: 434-924-1992
www.virginia.edu/vpr/irb/sbs.html

UNIVERSITY of VIRGINIA

monique jesionowski <msj5dd@virginia.edu>

Written permission to conduct DNP proposal in ED.

Hinger, Meghan R *HS <MRH9R@hscmail.mcc.virginia.edu> Mon, Jul 18, 2016 at 5:02 PM
To: monique jesionowski <msj5dd@virginia.edu>

Hi Monique,

I'm sorry I missed your presentation last Tuesday! I am sure you were fantastic.

I would also like to follow up to our conversation and let you know that the Emergency Department Leadership team grants you permission to conduct your DNP scholarly project in the ED.

Please let me know if you need anything else,

Meghan

From: monique jesionowski [mailto:msj5dd@virginia.edu]
Sent: Thursday, July 14, 2016 12:22 PM
To: Hinger, Meghan R *HS
Subject: Written permission to conduct DNP proposal in ED.

[Quoted text hidden]

Appendix E

Draft Publication Manuscript:

Does a Provider in Triage and Rapid Medical Evaluation

Help with Left without Being Seen Rates and ED Crowding?

Contribution to Emergency Nursing Practice

- Builds upon previous evidence supporting the benefits of RME/PIT to tackle ED crowding
- Incorporates ED staff perceptions in combination with quantitative data to evaluate interventions to understand clinical significance

Problem: To combat increasing emergency department (ED) crowding and elevated *left without being seen* (LWBS) rates, emergency departments have used interventions such as *rapid medical evaluation* (RME), and/or the physician or *provider in triage* (PIT) to initiate diagnostic interventions, and discharge any patients not requiring further emergency department evaluation.

Methods: An emergency department at a rural academic medical center evaluated the effect of newly implemented RME and PIT on ED crowding variables measuring LWBS rates, door-to-disposition times, & ED *length of stay* (LOS). Data pre-implementation was compared to post-implementation, and staff perspectives were gathered.

Results: Results Post-RME results demonstrated a statistically significant improvement in door-to-disposition times for the ESI level 5 or routine patients (p=0.037). No statistically significant differences were identified in other variables of interest post-RME, despite a higher acuity population sample which may demonstrate a beneficial effect of the RME. Post-RME with PIT

days were calculated to have statistically significantly longer door-to-disposition times (p=0.022) than RME with PIT, for ESI level 4 less urgent patients and for overall ED LOS of admitted patients (p=0.023). Additionally, qualitative findings support the overall benefit of the RME, despite mixed preferences between RME with PIT versus nurse protocols, desires for enhanced procedures, and reports of increased stress with the RME workload.

Implications for Practice: The findings support and build on other studies that demonstrate the RME is beneficial on ED crowding metrics. The PIT is a feasible triage strategy to employ in an academic medical center but should be revaluated after enhanced policies. Future emergency department initiatives would benefit from also gaining staff perceptions to support or refute quantitative evaluation of efforts.

Key words: Emergency Department crowding; Triage; Rapid Medical Evaluation; Provider in Triage; Physician in Triage; Left without Being Seen.

Does a Provider in Triage and Rapid Medical Evaluation Help with Left without Being Seen Rates and ED Crowding?

The American Colleges of Emergency Physicians (ACEP) defines emergency department (ED) crowding as the inability to accommodate patients in a timely manner due to space.[1] *ED crowding* occurs when the demand for services does not match available resources; usually when there is no treatment bed or appropriate professional staff available. The inability to see patients quickly due to space constraints, intuitively results in prolonged wait times.

The opportunity for improvement exists as ED wait times range from roughly an hour to 4 hours nationally.[2] In addition, 28% of patients have an ED *length of stay* (LOS) greater than 4 hours[3], impacting the ability to bring new patients back within the ED. With longer wait times, there is a greater likelihood of patients leaving prior to care[1], also called *left without being seen* (LWBS). According to Chan, et al.[4], the LWBS rate is considered a valid indicator of ED hospital overcrowding. The ACEP task force report on ED crowding[1] recommends that emergency departments with overwhelming capacity issues institute a program that places a physician in triage to identify and initiate care for higher acuity patients and to discharge minor patients. Similarly, the *Emergency Nurses Association 2014 position statement on Holding, Crowding, and Patient flow,* recognizes that crowding is a hospital-wide systems issue and encourages emergency nurses to be involved in research, development and solutions to address crowding.[5]

Patients who registered but LWBS account for 2.0% of all emergency department visits, according to the 2011 National Ambulatory Medical Care Survey for Emergency Departments.[2] This national percentage gives a false impression that ED crowding is not of

great concern. However, the LWBS rate varies depending on the hospital specialty service capabilities, the size of hospital, where it is located, and the characteristics of the population it serves. The severity of a patient's condition who LWBS is also variable. As a result, every patient who leaves without being seen is a cause for concern because a severely ill patient may be walking away untreated. Therefore, targeted evidence based strategies to decrease LWBS rates are needed to improve access to timely appropriate treatment, prevent adverse reactions, and promote healthy outcomes.

Problem

The target ED had variable LWBS rates, some of which surpassed the 1.8% unit goal. The higher than desired LWBS rates and indicators of ED crowding were concerning to administration and team members. Additionally, hospital systems engineers informed leadership that Monday was the busiest day of the week with a 6% higher volume. [6] The greatest census occurred during the evening and the emergency department was frequently at capacity early in the afternoon. Data also revealed that Emergency Severity Index (ESI) category 3 patients had the highest average waiting time from registration to room placement and that 60% of all ED visits are ordered labs and around 40% have a radiologic exam. [6] ED leadership's intent was to target these ESI 3 patient population through use of RME and PIT to reduce time and LWBS, who by ESI criteria require two or more resources such as labs or radiologic exams.

Setting

The site for this practice improvement project was the emergency department at an academic medical center (AMC). The emergency department registers approximately 61,000 annual visits with an approximate 25% admission rate from these visits.[6] The AMC is a rural safety net

tertiary care hospital. The RME/PIT program was housed in a newly selected area of the emergency department that was an expansion of the old triage space with five spaces available for either triage, and diagnostic or treatment interventions.

Methods

To combat ED crowding, the RME, was opened to support early diagnostic interventions and protocols during periods of increased volume; especially for those middle acuity ESI 3 patients who spend the longest time in the emergency department, plus require labs or radiologic exams. The RME existed in addition to a traditional fast-track. The RME was operationalized through the use of RN protocols. Additionally, the emergency department piloted the supplementation of RME with a PIT who would order the RME diagnostic interventions after triage without use of a protocol, further evaluate and initiate treatment, or discharge patients as appropriate.

The goal of RME intervention was to begin diagnostic evaluation with the patient spending less than 15 minutes in a bay, and then return the patient to the waiting room until the patient could be placed in a treatment space. RME interventions were not done, with the exception of EKGs for chest pain, if wait times were less than 30 minutes and patients could be directly bedded to the main ED, express care, or pediatrics. Triage of patients took precedence over initiating RME interventions and discharges. Staff were educated on RME process prior to each shift.

For two months, the RME was staffed with two RNs and two ED techs on all 8 of the Mondays. This workforce pattern represented an additional ED tech resource which was greater than normal staffing level. One RN acted as the primary triage nurse and the other as the intake nurse who focused on patient placement and triaged as needed. Of the 8 Mondays, 4 days also

had a dedicated PIT work in the RME.

During this project, the PIT was a third year emergency medicine resident under the supervision of an emergency medicine attending physician. The third year residents voluntarily signed up for shifts in the RME as the dedicated PIT, which was normal practice. The established RME hours were from 1100 to 1900 and reflected the largest patient volumes in the department. This project was conducted over an 8 week period. The project captured data on the ED workflow on high-capacity Mondays only, in order to avoid the introduction of variability due to day of the week. There were four shifts with a dedicated PIT in RME and four shifts without a dedicated PIT as the comparison group.

On days with a dedicated PIT, nurse protocols were not utilized and all orders were placed in the computer by the PIT. The exception was the chest pain protocol. To provide expedient care to this potentially high-risk population, the emergency nurse or tech did not have to wait for an order if the PIT was occupied with another patient. This allowed RME staff to continue to initiate EKGs as soon as patients presented to the emergency department. The dedicated PIT either listened passively to triage assessment or further evaluated patients once placed in RME bay. All nursing protocols were initiated in the RME on days without a dedicated PIT.

In addition, staff perceptions of the RME with and without PIT were obtained through focus groups to garner a comprehensive understanding of the process improvement initiative.

Results

The Pre-RME patient population consisted of 1417 patients with an average age of 41 years old. The majority were non-Hispanic (93.8%), female (51.6%), and white (66.0%). The Post-RME

population included 1469 individuals with an average age of 42 years old. The majority were non-Hispanic (93.7%), female (54.6%), and white (65.3%). Pearson's chi square demonstrated no statistically significant difference in age, gender, ethnicity, race, or disposition between the populations. There were more ESI 2-3 in the post-RME population (1019, 73.9% vs. 938, 69.3%; p=0.029) which means a higher acuity post-RME. However, the LWBS rate was not statistically different between populations (5.6% vs 5.4%; *p*=0.029).

Similar findings were noted in the RME with and without PIT samples. The RME with PIT population was comprised of 714 patients. The RME without PIT population included 755 patients. Pearson's chi square demonstrated no statistically significant difference in age, gender, ethnicity, race, or disposition between the populations. Furthermore, the LWBS rate was not statistically different between populations (5.5% vs. 5.3%; *p*=0.482).

Results from evaluation of the RME (see Table 1), demonstrated a statistically significant improvement in mean door-to-disposition times for ESI 5 or routine patients by greater than 58 minutes (p=0.037). No statistically significant differences were identified in other variables of interest post-RME. Post-RME with PIT days were calculated to have statistically significantly longer door-to-disposition times (p=0.022) than RME without PIT, for ESI level 4 less urgent patients and for overall ED LOS of admitted patients (p=0.023) (see Table 2).

In addition to the quantitative metrics, staff perceptions reflected qualitative findings. Through Post-RME/PIT focus group sessions, staff beliefs about the processes were explored. Staff felt that the RME was beneficial yet held mixed preferences between working with or without a PIT. Additionally, a desire for enhanced procedures was clearly stated as well as the struggles of an increased stress with RME workload.

Table 1. Mean Times Pre and Post-RME sample*

Intervention	Pre-RME	Pre-RME	Post-RME	Post-RME	Missing analysis			
Acuity[a]	n	Mean (h:mm:ss)	n	Mean (h:mm:ss)	Number of cases	Mean Difference	t test	
Null Acuity	9	2:55:53	5	2:00:48	40	-0:55:05	0.245	n.s.
ESI 1	5	1:14:00	4	1:40:45	2	+0:26:45	0.298	n.s.
ESI 2	173	3:36:16	219	4:03:00	8	+0:26:44	0.079	n.s.
ESI 3	765	4:46:10	800	4:52:07	103	+0:05:57	0.474	n.s.
ESI 4	323	3:11:18	300	2:57:28	55	-0:13:50	0.125	n.s.
ESI 5	**36**	**2:59:23**	**23**	**2:00:42**	**16**	**-0:58:42**	**0.037**	**sig**
Missing	106		118		N/A			
Total	1417		1469					

*Rapid Medical Evaluation (RME). [a]Acuity defined by Emergency Severity Index (ESI) level used in triage. The most emergent patient requiring lifesaving measures is ESI 1 and the lowest resourced routine patient is ESI 5. [b]*Emergency Department Length of Stay (ED LOS).* $p<0.05$ for significance

Table 2. Mean times of RME without PIT** versus RME with PIT*

Intervention	RME w/o PIT	RME w/o PIT	RME with PIT	RME with PIT	Missing analysis			
Acuity[a]	n	Mean (h:mm:ss)	n	Mean (h:mm:ss)	Number of cases	Mean Difference	t test	
Null Acuity	3	2:21:20	2	1:30:00	20	-0:51:20	0.584	n.s.
ESI 1	3	1:56:40	1	0:53:00	1	-1:03:40	0.263	n.s.
ESI 2	118	4:00:09	101	4:06:18	3	+0:06:09	0.757	n.s.
ESI 3	404	4:44:19	396	5:00:05	64	+0:15:45	0.157	n.s.
ESI 4	**153**	**2:43:41**	**147**	**3:11:49**	**25**	**+0:28:09**	**0.022**	**sig**
ESI 5	12	1:44:35	11	2:18:16	5	+0:33:41	0.228	n.s.
Missing	62		56		118			
Total	755		714					
Disposition **ED LOS[b]**								
Admission ED LOS	**205**	**7:32:00**	**175**	**8:25:00**	**1**	**+0:53:00**	**0.023**	**sig**
Discharges	491	4:26:00	484	4:46	0	+0:20:00	0.052	n.s
Total	696		659					

*Rapid Medical Evaluation (RME). **Provider in Triage (PIT). [a]Acuity defined by Emergency Severity Index (ESI) level used in triage. The most emergent patient requiring lifesaving measures is ESI 1 and the lowest resourced routine patient is ESI 5. [b]*Emergency Department Length of Stay (ED LOS).* $p<0.05$ for significance

Discussion

Despite the increased acuity of the patient population in the post-RME grouping, the LWBS

remained stable. The stability of the LWBS rate regardless of the higher acuity highlights a potential benefit of RME. Perhaps, the faster pace at which lower acuity patients (ESI 5) were treated and discharged decreased crowding and improved satisfaction, therefore impacting LWBS rates.

The RME with PIT made no statistically significant difference in terms of LWBS and a statistically significant increase in ED LOS of admissions and door-to-disposition times of ESI 4 more urgent patients, leading one to believe the RME with PIT was of no benefit. Perhaps these results were based on the fact that the PIT process was a new intervention and processes were not well established. The limited number of days, in combination with this intervention only occurring on Mondays may not have allowed staff to get comfortable and proficient at the tasks. Nursing and ED staff could have spent time discussing and clarifying next steps with more senior nurses and providers discovering what actions needed to occur with the space and new abilities to admit, transfer, and discharges. Since the PIT was an emergency medicine Resident, increased times could also reflect additional time spent in RME waiting for the required Attending patient evaluation prior to any admissions, transfers or discharges. Utilizing an Attending physician or allowing nurse practitioners or physician assistants who are an independent providers as a PIT, could have decreased the time the patients spent in the RME which also occupies a room when the nursing staff might be ready to initiate care on the next patient in the waiting room. This finding was partially supported by staff comments pointing to PIT inefficiencies compared to the RME days without PIT. However, staff also shared the experiences of sending patients directly to the operating room or discharged directly from the RME; the ability to quickly identify patients that could transition to another level of care is clearly beneficial.

Of note, during the study period, the EMR system did not support the PIT assigning oneself as the provider caring for a patient in an RME bay which reflects that a patient was seen in the RME and evaluated by the provider. If captured, LWBS patients would have been categorized as "left without discharge" reflecting a provider evaluation and then not included in the LWBS rate, decreasing LWBS results for RME w/ PIT compared to RME w/o PIT. This EMR improvement also may allow comparison of time to interventions, and of patients who arrived through RME compared more directly to those who did not.

The results of this project are clinically significant. The statistically significant decrease Post-RME of ESI 5 door-to-disposition times by over 58 minutes could translate into increased throughput. It equals more time to triage a patient every 3-5 min and or more time to take care of more acute patients. Clinically the RME w/ PIT may have prolonged triage and interventions could have contributed to the increased times for ED LOS of Admissions and door-to-disposition times for ESI 4 urgent patients. However focus group participants mentioned that patients were discharged from RME and that sick patients were identified and sent directly to the OR, or admitted also showing clinical benefit. Additionally, the focus group findings are invaluable to highlight specific areas to target improvements clinically that would not have been received from an only quantitative analysis.

Future RME/PIT projects should include strategies to mitigate increased stress through systems improvements. Considerations may include the reallocation of resources to compensate for frontload work with a flow coordinator, or additional RNs and ED techs. Frequently used items in RME should be stocked nearby to eliminate wasted time searching for equipment or medications. Policies and procedures should be written that clarify RME scope for medications and clarify procedures for direct admissions, discharges, and transfers of patients. Additionally,

optimization of the EMR to improve communication of tasks in a consistent, user-friendly, efficient manner should be integrated.

Implications for Emergency Nurses

The findings support and build on other studies that demonstrate the RME is beneficial on ED crowding metrics. The PIT is a feasible triage strategy to employ in an academic medical center but should be revaluated after enhanced policies. Future emergency department initiatives would benefit from also gaining ED staff perceptions to support or refute quantitative evaluation of efforts.

Conclusions

In conclusion, the RME maintained and reduced ED crowding metrics despite higher acuity patients which were supported as staff perceived that the RME was beneficial yet held mixed preferences between working with or without a PIT. However, the ED staff also experienced increased stress with the increased workload. RME w/ PIT showed no statistically significant difference in LWBS but a significant increase in door-to-disposition time of ESI 4 and ED LOS of Admissions compared to RME w/o PIT. Additional re-evaluation is needed after enhanced procedures to determine if RME w/ PIT is more, or less effective as nurse protocol only on RME w/o PIT days. There were clinical benefits of the RME particularly for the sickest patients who received care in a more timely fashion by having the ability to initiate treatment and on days with a PIT to also manage disposition straight from the RME. Additionally, RME w/ PIT enhanced throughput for ESI 5 patients. RME/ PIT are a feasible solution to tackle ED crowding.

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