REDUCING ED LENGTH-OF-STAY AND OVERCROWDING

REDUCING EMERGENCY DEPARTMENT LENGTH-OF-STAY AND OVERCROWDING
THROUGH TEAM TRIAGE

A Scholarly Project

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Kirsten Gisela Sizemore

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Lynchburg, VA

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ABSTRACT

Emergency department (ED) overcrowding is an internationally studied phenomenon linked to adverse patient outcomes, including death. Early medical screening exams (MSE) may prevent morbidity and mortality. Yet, EDs struggle to evaluate, treat, and discharge patients within recommended and nationally monitored benchmark times. This evidence-based scholarly project explored if stationing an advanced practice provider (APP) in triage would improve door-provider-times, length-of-stay (LOS), and the left without being seen (LWBS) rate at a medical center ED in the southeastern United States. A pre- and post-intervention design compared benchmark times after a provider triaged alongside the registered nurse (RN) during times of high census. The provider performed MSE and ordered diagnostic tests. Comparison of the two triage methods showed a significant reduction of median door-to-provider time, a decrease in LOS, and decline in LWBS rates. These findings indicate that stationing a provider in triage during times of high patient census can improve benchmark times and overcrowding.

Keywords: ED overcrowding, ED quality indicators, team triage, provider in triage (PIT), patient flow, and throughput metrics.

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List of Abbreviations

Advanced practice providers (APPs)

American College of Emergency Physicians (ACEP)

Center for Medicare & Medicaid Services (CMS)

Collaborative Institutional Training Initiative (CITI)

Community ED Overcrowding Scale (CEDOCS)

Cumulative Index to Nursing and Allied Health Literature (CINAHL)

Doctor of Nursing Practice (DNP)

Elton B. Stephens Company Host (EBSCO host)

Emergency department (ED)

Emergency Severity Index (ESI)

Frequency distribution (*F*)

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS)

IBM Statistical Package v.25 for the Social Sciences (SPSS)

Institutional Review Board (IRB)

Left without being seen (LWBS)

Length of stay (LOS)

Medical Information Technology, Incorporated (MEDITECH®)

Medical screening exam (MSE)

Merit-Based Incentive Payment System (MIPS)

National ED Overcrowding Scale (NEDOCS)

Primary care provider (PCP)

Provider in Triage (PIT)

Rapid Access Zone (RAZ)

Samples (*n*)

Value-Based Purchasing (VBP)

SECTION ONE: INTRODUCTION

Emergency department (ED) overcrowding has become an increasing, nationwide problem and is often associated with increased patient morbidity and mortality. The resulting prolonged wait times have led to decreased patient satisfaction (Spencer, Stephens, Swanson-Biearman, & Whiteman, 2019). Other consequences of ED overcrowding include undesirable financial penalties assessed to healthcare institutions due to unmet clinical performance measures (Wiler et al., 2015). A literature review identified numerous interventions to reduce ED crowding, but few studies explored the effects of adding a provider to triage to improve ED benchmark times in detail. Thus, the purpose of this evidence-based scholarly project was to decrease ED overcrowding by stationing an advanced practice provider (APP), such as a nurse practitioner (NP) or physician assistant (PA) in triage (PIT) during times of high census and rapid patient influx.

Background

ED overcrowding occurs when there are insufficient resources, such as treatment rooms, providers, and nurses to care for the number of patients who seek care. Recent changes in healthcare, such as value-based purchasing (VBP), the induction of the Medicare Access and Chip Reauthorization Act of 2015, and the Merit-Based Incentive Payment System (MIPS) have called new attention to more efficient and safer ED operations (Medford-Davis, Marcozzi, Agrawal, Carr, & Carrier, 2017). A sharp increase in patients presenting to EDs nationwide was first seen after the induction the Emergency Medical Treatment & Labor Act of 1985 (Hayden, Burlingame, Thompson, & Sabol, 2014) and again after the Affordable Care Act of 2010 was passed (Hosseinichimeh & Weinberg, 2014).

Additional causes of larger numbers of visits to EDs include patients who are sent by their primary care providers (PCPs) for non-urgent testing (Medford-Davis et al., 2017). When EDs are congested, patients spend prolonged times waiting for medical screening exams and disposition; subsequently, the potential for poor patient outcomes increases. For example, the incidence rate of death doubles in patients with cardiac complaints in busy EDs in comparison to EDs with lower patient census (Salway, Shoenberger, Mallon, & Viccellio, 2017). With long waiting times, patient satisfaction also declines (Scrofine & Fitzsimons, 2014).

This evidence-based scholarly project explored the effects of team triage on overcrowding at a medical center ED in the southeastern United States. As most EDs in the nation, this ED is not exempt from overcrowding. Historically, Sundays and Mondays are days which average the highest patient census. Door-to-provider times and door-to-discharge times often exceed national- and state-acceptable quality measures. In addition, patient satisfaction has been lower, and more patients left without being seen (LWBS) as waiting times increased. Numerous strategies to improve patient flow, such as pivot nursing, an ED technician in triage, and a charge nurse monitoring of benchmark times were already in place prior to initiating this project. Despite these efforts, median door-to-provider times are often greater than 22 minutes, door-to-discharge times surpass the acceptable interval metrics of 240 minutes, and LWBS rates were higher in comparison to state and national averages.

Problem Statement

Successful reduction of ED overcrowding is challenging, time consuming, and requires multiple, coordinated resources. Although previous studies investigated various triage methods to reduce overcrowding, few explored the effectiveness of a PIT/team triage model. By using

the RN only triage model, this ED has not effectively investigated methods for reduction of overcrowding; therefore, door-to-provider times and length of stay (LOS) remain above state and national benchmarks.

Purpose of the Project

The primary purpose of this evidence-based project was to decrease ED overcrowding. The intervention was to station a provider in triage during times of high census and rapid patient influx. The aims of the project were to decrease median door-to-provider time, median door-to-discharge time, and LWBS rates.

Clinical Question

During times of ED overcrowding (**Problem**), can a PIT/team triage (**Intervention**) reduce door-provider times, patient LOS, and LWBS rate (**Outcomes**) in comparison to RN only triage (**Comparison**)?

SECTION TWO: LITERATURE REVIEW

The purpose of this literature review was to discover and summarize current knowledge and evidence regarding ED overcrowding, team triage, and associated concepts. The literature explored gaps in existing knowledge and identified variances among existing triage strategies. Findings were critically appraised, synthesized, and organized to answer the clinical question: During times of ED overcrowding, can a PIT/team triage reduce door-provider times, patient LOS, and LWBS rate?

Explanation of terms for the purpose of this project.

- Door-to-provider time: The time a patient first presents to the ED to time of medical

screening exam (MSE) (Murphy, Barth, Carlton, Gleason, & Cannon, 2014).

- ED overcrowding: When the number of patients who seek treatment in the ED is greater than the availability of beds and means to care for patients, for example, insufficient number of ED techs, nurses, and providers (Wallingford et al., 2018).

- Length of stay (LOS): Average time in minutes from arrival at ED to discharge or admission.

- Left without being seen (LWBS): Percentage of patients who present to the ED for care and left prior to MSE (Murphy et al., 2014).

- Provider: Nurse practitioner (NP), physician assistant (PA), or physician.

Search Strategy

The various search engines used for methodical literature search include CINAHL, EBSCO host, Cochrane Database of Systematic Reviews, Medline, ProQuest Nursing & Allied Health Database, and PubMed. Keywords and search phrases used were ED overcrowding, ED quality indicators, team triage, provider in triage (PIT), patient flow, and throughput metrics. The search parameters were set for peer-reviewed articles written in the English language and published within the past five years. Twenty-two articles met inclusion criteria for the literature review. These articles were retrieved from various journals, including the *Journal of Nursing Administration*, the *Journal of Emergency Nursing*, the *Journal of Research in Medical Science*, *Health Marketing Quarterly*, the *Journal of Biomedical Informatics, and Academic Emergency Medicine* to provide a broad, multidisciplinary overview of overcrowding and associated concepts.

Synthesis

ED overcrowding affects all sizes of facilities, community hospitals, teaching institutions, and major trauma centers across the United States. This phenomenon has also existed throughout Europe (Burstrom et al., 2016; Improta et al., 2018; Lauks et al., 2016), Australia, and New Zealand (Jennings, Clifford, Fox, & O'Connell, 2016). Pre- and post-interventional studies seem to be a favored design to explore the effectiveness of interventions to improve ED flow and overcrowding reduction, yet studies conducted in various facilities are often difficult to compare due to lack of common terminology. Causes of ED overcrowding are multifold. A commonly reported theme is an increase in patient census over the last few years. In addition, hospitals have internal causes of bottlenecking unique to their facilities. Due to the frequency of overcrowding, researchers explored numerous interventions to bring about improvement (Yarmohammadian, Rezaei, Haghshenas, & Tavakoli, 2017). This is complicated by the fact that one intervention may be statistically successful in one hospital, but it may do little to improve conditions in other facilities. No single intervention has consistently demonstrated improvement in ED overcrowding and improvement of ED quality indicators. Thus, choosing good interventions maybe difficult for future projects.

Critical Appraisal

ED overcrowding. Scrofine and Fitzsimons (2014), Hayden et al. (2014), and Yarmohammadian et al. (2017) acknowledge ED overcrowding is multifactorial. Scrofine and Fitzsimons (2014), Improta et al. (2018) and Yarmohammadian et al. (2017) recommended using multiple traditional interventions to make notable improvements, while Hayden et al. (2014), Wallingford et al. (2018), and Jesionowski, Riordan, and Quatrara (2019) used a single

intervention, such as PIT and rapid access zone (RAZ) to improve ED overcrowding. Spencer et al. (2019) used a PIT and revamped their current RAZ to improve benchmark times.

A unique approach to examining ED overcrowding is to focus on patients' perception of ED time metrics in contrast to actual time intervals. This non-interventional approach may bring about non-traditional ideas which could make LOS seem shorter for patients who present to the ED for treatment (Davenport, O'Conner, Szychowsky, Landry, & Hernandez, 2017). In contrast to the other pre- and post-interventional research, Lauks et al. (2016), Improta et al. (2018) and Burstrom, Engstrom, Castren, Wiklund, and Enlund (2016) draw attention to the universality of ED crowding since their studies were conducted in Europe. In Australia and New Zealand, ED overcrowding hinders delivery of safe and timely emergency care (Jennings et al., 2014). According to Weiss, Rogers, Maas, Ernst, and Nick (2014) there is a lack of clear indicators which define ED crowding; therefore, their focus was not on introducing new interventions but to propose the use of a tool which determines if community EDs experience crowding. The authors found the Community ED Overcrowding Scale (CEDOCS) to be more accurate for EDs with fewer than 40,000 annual ED visits in comparison to the National ED Overcrowding Scale (NEDOCS). Ming et al.(2016) set themselves apart from other studies by conducting the first systemic review and meta-analysis to answer if team triage can improve patient care.

Causes of overcrowding may be due to organizational culture and absence of traditional throughput methods, such as direct bedding and point of care diagnostics at a small satellite ED (Scrofine & Fitzsimons, 2014). A main contributor to ED overcrowding in a community hospital is lack of primary care access (Hayden et al., 2014). Davenport, O'Conner, Szychowsky, Landry, and Hernandez (2017) focused on patient perspectives of their ED visits using a

qualitative approach at a community hospital. They speculated crowding is associated with a substantial increase of ED visits in general over the last view years. In addition to the above factors of ED crowding, Pierce and Gormley (2016) also mentioned an aging population as a contributing factor. Other reasons for ED crowding may be associated with lack of situational awareness. Franklin et al. (2017) described this phenomenon as a lack of departmental overview by providers who subsequently focus on isolated tasks instead of patient flow in general. Jesionowski et al.(2019) conducted their quality improvement project at a medical academic hospital and noted ED crowding was most pronounced on Mondays. Another reason for crowding noted in a Level I Trauma Center is inconsistent patient placement to the RAZ (Spencer et al., 2019). Furthermore, Morais et al. (2018) reported a disproportion in waiting times, times patients spend in the ED, and times to discharge to be a major contributing factor to overcrowding.

Unique in their approach, Wiler et al. (2015) differentiated between internal and external causative factors for ED crowding. Internal causes are associated with hospital-specific reasons, such as limited staff, lack of specialty providers within the community or the facility, and characteristics and number of patients who present to EDs. External reasons are associated with community health in general and payor sources of potential patients. These descriptions of causes are the result of an expert panel meeting which discussed ED overcrowding. While many in this field have a vast knowledge of ED practices and overcrowding, only 30 experts participated in this dialogue. Other, internal causes of ED crowding are extended time periods from providers' decision to admit patients until physical transfer of patients from the ED to inpatient beds (Lauks et al., 2016). Historical increases in ED census over the last few years also

contribute to ED crowding (Wallingford et al., 2018).

      ED quality indicators. Wiler et al. (2015) provided an expert opinion of operational

definitions associated for ED benchmark times; however, the article has little to contribute

beyond use of definitions due to the low level of evidence. Additionally, expert consensus

resulted in agreed upon definitions, and, therefore, definitions are not necessarily reflective of

terminology used nationwide. In a pre-and post-interventional study that utilized multiple

strategies to decrease overcrowding, Scrofine and Fitzsimons (2014) reported a 5% reduction of

patients who LWBS, a 40% decrease in arrival to triage time, and LOS was decreased by 6

minutes. By utilizing a split-flow model with simultaneous PIT, Pierce and Gormley (2016)

were able to improve total LOS times of ED patients by 9% in comparison to a similar ED which

used traditional, RN-only triage. In a pediatric ED (PED), Muller, Chee, and Doan (2018) found

LWBS and LOS time reduction to be statistically significant during times NPs were working in

the department. Furthermore, patient satisfaction scores, as measured by the Press Ganey survey

improved by 15%. Hayden et al. (2014) , Morais et al. (2018), and Burstrom et al. (2016) found

significant reduction of door-to-provider time after placing a PIT. While Hayden et al. (2014)

discovered no improvements in LWBS and LOS, Burstrom et al. (2016) reported a 34-minute

faster door-to-discharge time with a PIT. As with Hayden et al. (2014), crowding metrics were

compared in a pre-and post-interventional design by Jesionowski et al. (2019); however, this

project could not report improvement in any of the ED quality indicators when stationing a PIT.

A coincidental finding was the improvement of throughput times in Emergency Severity Index

(ESI) level 5 patients. Lack of improvement in overall benchmark times may be due to a limited

sample of only ESI level 3 patients, instead of including all patients who presented to the ED.

Wallingford et al. (2018) also focused their interventions on improving ESI level 3 throughput and reported a noteworthy reduction in overall LOS. Their primary intervention was to place ambulatory ESI level 3 patients in a designated treatment area. Age bias may have skewed results, since most patients treated in this designated space were younger in contrast to patients treated in the main ED. During a retrospective chart review, Reinhardt (2017) noted door-to-provider times are higher during peak hours in ESI level 2 patients in comparison to non-peak hours. The small sample and lack of door-to-provider times recorded during non-peak hours limit the significance of this result. Noteworthy, however, is the author's explanation of acceptable door-to-provider times based on ESI levels when using Canadian and Australian triage scales.

Spencer et al. (2019) were able to demonstrate a 43-minute improvement in door-to-provider times, 10.38% drop in LWBS rates, and decreased overall LOS through a combination of PIT and RAZ improvements. However, their intervention did not improve patient satisfaction. Davenport et al. (2017) also failed to show a correlation between actual ED wait times and patient satisfaction. However, if patients thought their wait times were short, they were more satisfied with their ED visits. Due to the nature of their study, Franklin et al. (2017) were unable to use timed quality indicators as outcome criteria, yet they noted behaviors in providers which has the potential to better benchmark times due to enhancement of work processes. In a large tertiary care center, Lauks et al. (2016) achieved significant improvements in lowering LOS for ESI level 5 patients. However, ESI level 2, 3, and 4 patients had an increased LOS. Overall, door-to-provider times decreased. While there is an assumption that Switzerland has similar causes of ED crowding, this study may not be easily generalizable to United States EDs.

Improta et al. (2018) were able to decrease LOS and time to physical exam by using the LEAN approach. Because the researchers used multiple interventions, they were unable to determine if a single improvement method would yield comparable results, although key interventions may be useful when attempting to improve ED benchmarks. Singer et al. (2018) utilized point-of-care testing in triage to reduce total LOS in ED patients. Combing team triage with POCT therefore could yield an improvement in overall ED patient flow and associated benchmark times.

Team triage/PIT. Hayden et al. (2014) concluded using the PIT model had a limited effect on the overall ED quality indicators, yet they are optimistic that their study findings are useful in improving team triage/PIT to yield positive results in the future. Jesionowski et al. (2019) found limited value in adding a PIT and concluded this triage model to have potential use for ordering diagnostic tests if direct bedding is not possible. Because placing a PIT started simultaneously with improvements in RAZ, it was not possible to differentiate the impact of both interventions. Through systematic review and meta-analysis, Ming, Lai, and Lau (2016) concluded stationing a PIT has no substantial benefits. Searching multiple databases for relevant literature yielded few articles which met inclusion criteria. The aforementioned authors do not provide clear direction about using team triage in the future. The small sample size and lack of direction may be due to the relative newness of PIT/team triage.

Scrofine and Fitzsimons (2014) supported the PIT/team triage model. Since their study includes numerous, simultaneous interventions, it was difficult to determine if stationing a PIT as sole intervention would decrease overcrowding and improve benchmarks. Spencer et al. (2019) affirmed the use of team triage can make positive differences. In addition to benchmark

improvements, the authors recorded financial benefits. Even paying extra wages to providers to

staff triage, the cost savings estimate was $806,000 during the 6 months study period. While

Yarmohammadian et al. (2017) supported the team triage concept after systematic review, they

noted a PIT may lead to additional expenditure for hospitals in contrast to Spencer et al. (2019).

Although Davenport et al. (2017) described a non-interventional study without PIT or team

triage, one may assume the team triage model could be supported since patients may believe

their ED visits to be swifter by seeing a provider earlier in their stay.

Lauks et al. (2016) also supported team triage. Additionally, their study expanded on the

team triage concepts by outlining patient flow according to ESI level after the completion of the

MSE. Limitations included simultaneous changes in patient registration, redesign of rooms, and

change in electronic medical records; therefore, it is difficult to know if improvements were

solely related to a PIT. Burstrom et al. (2016) additionally supported the team triage model. In

addition to benchmark time improvements, their most sustaining evidence was a statistical

reduction in patient morbidity and mortality during the two-year study period. Although the PIT

was a physician, APPs could bring about equal results. In a randomized controlled trial, a

medical provider stationed in triage significantly reduced total ED LOS, time patients occupied

ED beds, and LWBS rate during times of overcrowding and high census. The triage provider

performed a medical screening exam and entered diagnostic orders for patients who presented to

the ED with abdominal pain (Begaz, Elashoff, Grogan, Talan, & Taira, 2017). A rapid

assessment team (RAT), comprised of a nurse and physician, has reduced LOS by a minimum of

30 minutes in a literature review. Additional benefits of team triage in this review include

increased patient satisfaction and decreased LWBS rate. This model of triage was also cost

effective when used during times of high patient census (Ross, 2017). A table of evidence

summarizes the above findings (Appendix A).

Conceptual Framework—Iowa Model

The Iowa Model of Evidence-Based Practice guided this scholarly project. The

University of Iowa Hospitals and Clinics permitted the use of this framework (Appendix E).

Before implementing or piloting evidence-based projects, nurses can use the Iowa Model to

assure the proposed project is of significance (Buckwalter et al., 2017; White, 2016). In the past,

the focus of the Iowa Model was on choosing a project of interest to the overall organization. A

revision broadened the focus to allow for the model's application in organizational subsystems,

such as the ED, in addition to systemwide use (Buckwalter et al., 2017). Therefore, use of this

model helped to evaluate if adequate evidence existed to continue stationing a PIT beyond the

initial time of implementation or if there is a need to explore alternative methods for benchmark

reduction.

Triggering Issues and Organizational Priority. The review of various concepts

determined that reducing ED LOS, door-to-provider times, LWBS percentages, and

overcrowding are priorities for the medical center in the current scholarly project. According to

the American College of Emergency Physicians (ACEP), overcrowding is "when the need for

emergency services exceeds available resources for patient care in the ED, the hospital, or both"

(Wallingford et al., 2018, p. 346). After discussing potential benefits of a triage provider, the

medical director gave permission to implement this project.

Macrolevel. While overcrowding is a hospital-wide issue, it often begins in the ED. On

the macrolevel, the hospital's attempts to improve patient flow throughout the facility were

ongoing. Examples of continuing macrolevel improvement strategies are for admitting

physicians to immediately place an admission order into MEDITECH® after accepting a patient

for admission. In the past, hospitalists and other admitting physicians gave telephone orders to

ED nurses. This often led to delays in moving admitted patients to inpatient beds because many

orders needed clarification before admission could take place. In addition, nurses were busy

adding orders into MEDITECH® instead of focusing on calling report and facilitating patient

transfer to the receiving unit. By placing their own orders, hospitalists and specialty physicians

eliminate numerous steps which delay patient movement out of the ED.

Patient flow representatives and increased involvement by house supervisors and charge

nurses to facilitate patient placement throughout the facility have further expedited hospital wide

patient flow. Orders for patient admission through the ED, including diagnosis and type of

inpatient bed needed, display electronically in the patient flow and house supervisor's office after

provider entry. Therefore, bed assignments occur within a few minutes of admission order entry.

From an ED point of view, systemwide efforts may assist in moving admitted patients to

assigned units to free up ED beds more rapidly. However, bottlenecking also occurred at the

microlevel, beginning at triage.

Microlevel. On the microlevel, prolonged ED wait times are associated with higher

mortality rates, decreased quality of care, and lower patient satisfaction. Lengthy door-provider

times can lead to legal actions. One patient, for example, alleged a hospital neglected to perform

a timely medical screening exam and he subsequently suffered a cardiac arrest (Reinhardt, 2017).

Poor outcomes as in the aforementioned case may be preventable by reducing the arrival-to-

medical screening time by stationing a provider in triage. Using team triage, an RN and provider

could reduce the number of patients send to the main ED for evaluation because the provider can disposition ESI level 5 patients from triage or place patients to a fast track area (Franklin et al., 2017). As recommended by ACEP, this medical center's ED has a rapid access zone (RAZ). RAZ is comparable to fast track in function and types of chief complaints which are appropriate for evaluation and treatment in such a setting. Nursing triage protocols for major chief complaints, such as chest pain, dyspnea, abdominal pain, and extremity injuries, are also in place to speed initiation of diagnostic testing and patient flow. Upon initial evaluation, the triage nurse can enter corresponding protocol orders which may include labs, x-rays, and electrocardiograms (EKGs). Medications for fever and pain control are also available by protocol. On the microlevel, the only ACEP recommendation to prevent ED crowding not in place at this facility was team triage.

  Financial consequences of ED crowding. ED overcrowding has numerous effects on hospitals in general. Since the adoption of the Affordable Care Act in 2010, value-based purchasing has affected insurance reimbursements to hospitals based on individual hospital performance. ED performance measures are comprised of time intervals. The overall LOS is such measurement with further divisions into smaller, pertinent time intervals. Door-to-provider time is an important ED performance measure, which many EDs do not meet due to overcrowding (Wiler et al., 2015). At this medical center, nurse and provider trackers electronically display LOS, door-provider time, and other intervals in real time. When monitoring trackers, it often became apparent that this ED failed to meet crucial time markers consistently. Prolonged benchmark times occurred frequently, especially on days with high census and overcrowding.

In addition to time sensitive performance measures, prospective ED and hospital patients can review the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey online to ascertain the hospital they choose provides high quality care from the patient's perspective (Centers for Medicare & Medicaid Services [CMS], 2017). Roughly 50% of admitted inpatients enter the facility through EDs (Moore, Stocks, & Owens, 2017). Because of this, patients' perception of their ED stays play a critical role of the facility's total HCAHPS scores, although this survey does not elicit specific time intervals from ED visits.

Addressing deficiencies within hospital subsystems can lead to overall system improvement. EDs can partake in overall hospital quality improvement activities and patient flow by following the Institute for Healthcare Improvement change idea C9.2 "Improve efficiency in the ED to decrease LOS" (Rutherford, Provost, Kotogal, Luther, & Anderson, 2017, p. 18). To improve patient safety and satisfaction, meet national benchmarks, and increase reimbursement, patient flow through the ED should be a priority, not only for this ED, but for the entirety of this medical center.

Purpose. The primary purpose of this evidence-based project was to decrease ED overcrowding. The intervention was to station a provider in triage during times of high census and rapid patient influx. The aims of the project were to decrease median door-to-provider time, median door-to-discharge time, and LWBS rates.

Team, Assemble, Appraise, and Synthesize Body of Evidence. During this step, the project leader identified stakeholders and invited them to participate in gathering pertinent literature. The next phase consisted of amalgamating, synthesizing, and evaluating the collected literature to ascertain that ample peer-reviewed evidence existed to warrant change in current

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triage practices (Fencl & Matthews, 2017; White, 2016). At this medical center, all RNs must take a triage course before they can take a triage assignment. Such class material could be useful as the foundation for team triage. The team of stakeholders consisted of the project leader, the director of trauma and surgical services, and the ED performance excellence analyst. To include all areas of this ED, a physician and a charge RN representing the main ED also took part in this process. The project leader extended invitations to the ED manager and the ED medical director to attend meetings. To gain IRB approval, the project leader presented findings and appraisal of literature gathered prior to project implementation to the hospital research council, where members made additional suggestions for implementation.

Design and Pilot the Practice Change. Once it was determined that enough evidence exists to initiate team triage, the pilot project launched (Fencl & Matthews, 2017; White, 2016). Gathering of baseline data, consistent of average patient LOS, median door-provider times, and LWBS percentage prior to project implementation allowed comparison with data after project completion. The next step was construction of EBP team triage guidelines. The project leader, lead APP, and ED director reviewed the established guidelines periodically and revised as needed. During the pilot period, a provider triaged for an eight-hour shift, two days a week. Currently, the days of highest ED census are Sundays and Mondays; therefore, PIT piloting occurred on those days. The pilot shift was scheduled to cover an 8-week period of rapid ED patient influx, from 2 p.m. to 10 p.m. beginning in August 18, 2019 since higher patient census has been recorded during this time interval in the past. After completion of the designated pilot period, the project leader compared average patient LOS, median door-to-provider time, and LWBS percentage on team triage days to RN only triage days. Pre-intervention, RN only triage

days reviewed were Sundays and Mondays from 2 p.m. to 10 p.m. during the same months in the

year prior to piloting. The EBP team triage guidelines underwent revision before full practice

integration (White, 2016).

      Integrate and Sustain the Practice Change. Once the pilot project established a

provider in triage can bring about decreased LOS, improved door-to-provider times, a decrease

in LWBS rates, and reduced overcrowding in the ED, it is time to implement team triage on a

full scale. At the time of project implementation, funding for a triage provider was only

available for eight hours on Sundays and Mondays. However, if these additional provider shifts

consistently reduce LOS, door-to-provider times, LWBS rates, and subsequent bottlenecking,

additional monies may be made available to extend hours and/or add additional team triage days.

To gain further funding, continued monitoring of outcomes, such as LOS times, door-to-provider

times, LWBS percentages, and patient flow, as well as patient and staff satisfaction should occur

(White, 2016). Routine reporting to stakeholders after implementation of team triage may show

continued benefit of this practice change.

Summary

      Some studies suggest that PIT/team triage is an effective method to improve ED

overcrowding, reduce benchmark times, and subsequently improve patient satisfaction (Franklin

et al., 2017; Medford-Davis et al., 2017). Quality indicators, especially for ESI level 5 patients,

have improved by placing a PIT and through use of the team triage model (Jesionowski et al.,

2019). Most studies report significant improvement in door-to-provider times after team triage

was implement (Davenport et al., 2017; Lauks et al., 2016; Scrofine & Fitzsimons, 2014;

Spencer et al., 2019; Yarmohammadian et al., 2017). Spencer et al. (2019) were able to record

substantial improvements with the PIT/team triage model, decreasing total LOS by 43 minutes and LWBS rates by 10.38 percent. As NP and PA work hours increased, LOS times improved in one ED. This decrease in LOS consequently led to improved patient satisfaction (Scrofine & Fitzsimons, 2014). Yarmohammadian et al. (2017) pointed out that team triage is particularly helpful during high patient census and during times of overcrowding. Hayden et al. (2014) improved door-to-provider times and LWBS percentages by placing a PIT. Given the positive improvements in ED benchmark times utilizing team triage in prior projects, this scholarly evidence-based project was implemented to decrease ED overcrowding by stationing a provider in triage during times of high census and rapid patient influx. The aims of this project were to decrease median door-to-provider, median LOS, and to decrease the percentage of patients who LWBS.

SECTION THREE: METHODOLOGY

Measurable Outcomes

The overall desired goal of this evidence-based, scholarly project was to decrease ED overcrowding. The measurable outcomes were as follows:

1. Median door-to-provider times measured in minutes — the time from when a patient first presents to the ED to evaluation by a medical provider.

2. Median LOS measured in minutes — time in minutes from arrival at the ED to discharge.

3. LWBS percentage — patients who left the ED before being seen by a provider.

Setting

This scholarly, evidence-based project took place at a medical center ED in the

southeastern United States. This hospital serves a designated metropolitan statistical area and

has a total of 337 licensed beds. The hospital belongs to a not-for-profit system which totals 454

acute care and 110 extended care beds. The ED has 40 beds and 34,067 annual visits.

Improving ED benchmarks based on current evidence aligns with the facility's mission, vision,

and values "to provide the highest level of care and to be an innovative leader in healthcare

delivery and outcomes" (████████████████████████, 2017, p. 1). See Appendix D for a

copy of the project site letter of support.

Population

The population for this project contained ED patients who sought care at a medical center

ED during the 8-week period of intervention. This ED serves patients of all ages who present

with medical, traumatic, psychiatric, or obstetric emergencies. The patient population therefore

was comprised of infants, pediatric patients, adults, and older adults. The convenience sample

consists of all patients who presented to the ED on Sundays and Mondays between the hours of 2

p.m. and 10 p.m. Patients seen in triage and subsequently sent to other departments for further

evaluation, such as OB or infusion clinic, did not meet inclusion criteria. Private referrals for

medical treatment in the ED by primary care providers also did not meet inclusion criteria for

this pilot. The clinical excellence analyst queried MEDITECH® for the final pre- and post-

intervention samples.

Ethical Considerations

To ensure protection of human rights, the DNP project team (student and project Chair)

have completed research ethics training. Appendix C contains a copy of the student's

Collaborative Institutional Training Initiative (CITI) Certificate. The Liberty University

Institutional Review Board (IRB) served as the lead institution and approved the submitted

project proposal. The medical center IRB also reviewed the proposal and deferred to Liberty

University IRB. Appendix B contains a copy of both IRB approval letters.

Data Collection and Tools

The quality assurance analyst extracted pre-intervention data for the two-month period

prior to project implementation from MEDITECH® data repository, which is the electronic

health record (EHR) used in the ED. Data includes median door-to-provider times, median LOS,

and LWBS percentage. After placing a PIT, the analyst collected the same data for the two-

month post implementation period. Additional information gathered were ESI levels of all

patients and the total number of patients who were triaged during pre-and post-intervention

periods, since severity of illness and number of patients seen can greatly confound benchmark

times. The patients' age was the only demographic variable collected during this project. The

analyst converted data to a Microsoft Excel file and provided the file to the project leader for

analysis.

Intervention

The intervention for this evidence-based scholarly project was to place a PIT during

times of high census and rapid influx to decrease overcrowding. The project site previously

identified the busiest times as Sundays and Mondays from 2 p.m. to 10 p.m. Careful planning of

individual tasks and outlining which team members were responsible assisted in successful

project completion. In addition, a timeline which outlined expected dates of task completion was

beneficial for the scholarly project completion (Roush, 2015).

Feasibility Analysis. The project leader felt that sequential project implementation

would prevent major obstacles. The greatest difficulty anticipated was open communication

about impending change. RNs and ED technicians attend staff meetings and team huddles prior

to the beginning of each shift; these meetings allowed time for necessary discussions. Because

ED staff works varied shifts, not all stakeholders were able to attend meetings. As expected,

meetings and face-to-face interaction with providers were not always possible, thus the medical

director added pertinent information to monthly provider calls as different means of

communication. Funding was available to staff triage with providers during the pilot hours.

Prior to project implementation, the ED scheduler thought it may not be possible to have

provider coverage for each Sunday and Monday due to staffing issues. Therefore, the project

leader retrospectively reviewed the APP schedule at the end of the pilot period and assured that a

provider triaged on all pilot days. Even if the pilot study yields significant improvement in ED

door-to-provider time, LOS, and LWBS percentage, permanently implementing changes and

expanding PIT/team triage hours and days will dependent on finances rather than project

outcome.

Design

The IOWA Model for Evidence-Based Practice served as a sequential guide throughout

this scholarly project and for appraisal of practice change. According to the IOWA Model

Collaborative (2017), piloting is a tool which could assist in evaluating whether PIT/team triage

will bring about change as anticipated or if alternate models of triage should be considered to

reduce ED overcrowding. A pre- and post-intervention design is a valuable approach for

scholarly projects in medical settings and therefore was used for comparison of benchmark times

before and after a provider was stationed in triage (Thiese, 2014). The team leader

retrospectively obtained benchmark times for Mondays and Tuesdays for the 8-week period from August 19, 2018 to October 8, 2018, before PIT/team triage implementation. The team leader then compared times to an 8-week period on Mondays and Tuesdays, beginning August 18, 2019 and ending on October 7, 2019 while a provider was in triage.

Data Analysis

The IBM Statistical Package v.25 for the Social Sciences (SPSS) software aided in data analysis. Descriptive statistics explored were ages and ESI levels of all patients who undergone the triage process during the pre- and intervention timeline. Age variables—infant (0-12 months old, pediatrics (1-18 years old, adults (19-65 years old), and geriatrics (greater than 65 years old)—are summarized in a categorical frequency distribution (F) tables. Ordinal frequency distribution (F) tables display ESI levels.

Measurable Outcomes.

1. Median door-to-provider times measured in minutes, pre- and post-intervention.

2. Median LOS measured in minutes, pre- and post-intervention.

3. LWBS percentage — descriptive statistics using relative frequency to list total and pre-and post-intervention frequencies and relative frequencies (Sullivan, 2018).

SECTION FOUR: RESULTS

Descriptive Statistics

During the pre-intervention period, a total of 2,136 patients came to the ED on Sundays and Mondays and underwent RN-only triage. Of these patients, 1,325 (62%) ranged between 19-65 years of age, 472 (22.1%) were greater than 65 years old, 303 (14.2%) patients were between

the ages of 1 and 18 years, and 36 (1.7%) were less than one year of age. During the period with

a provider in triage (PIT), a total of 2,133 patients came to the ED on Sundays and Mondays. Of

these patients, 1,304 (61.1%) ranged between 19-65 years of age, 460 (21.6%) were older than

65 years, 298 (13.9%) patients were between the ages of 1 and 18, and 71 (3.3%) were less than

one year old. For comparison of age ranges during the 8-hour preintervention and PIT period,

data for the 2 p.m. to 10 p.m. timeframe are presented in Figure 1.
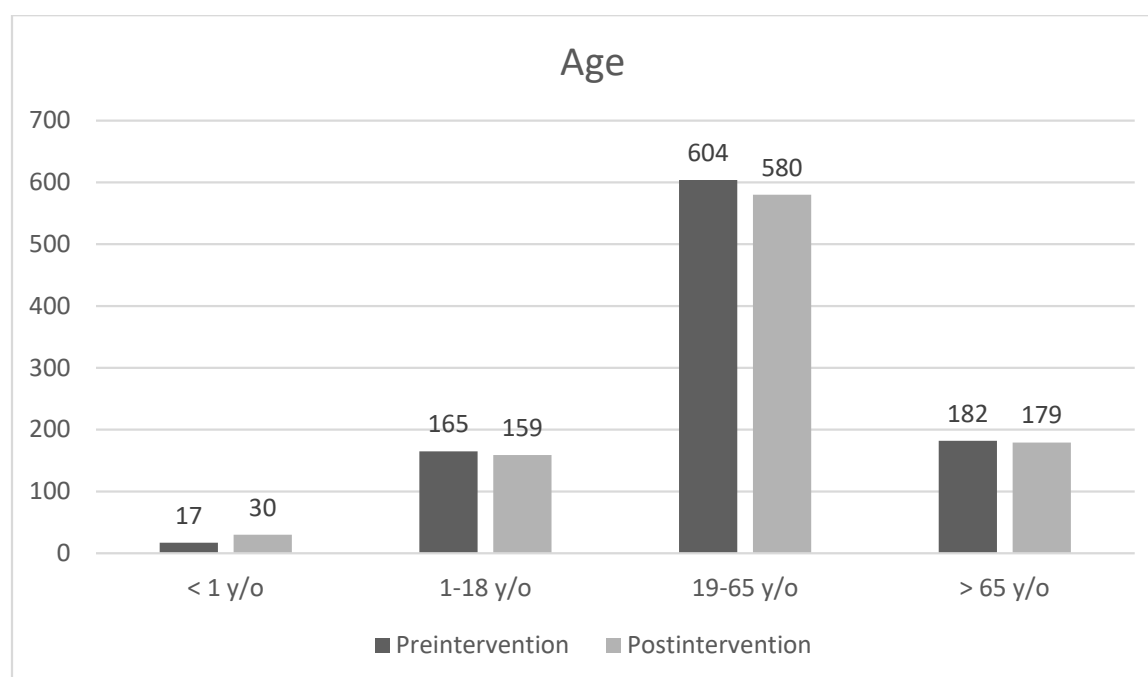
Figure 1. Age Ranges, 2 p.m. to 10 p.m.

Of the 2,136 patients who came to the ED during the pre-intervention period, 2,108

(98.7%) had an ESI level assigned in triage. Most frequently, triage nurses classified 1,179

(55.2%) patients as ESI level 3. Next, 465 (21.8%) patients ranked as ESI-level 2, followed by

412 (19.3%) of ESI level 4 patients. Less frequent were ESI level 5 patients, 38 (1.8%) and ESI

level 1 patients, 14 (0.7%). Of the 2,133 patients who came to the ED during the intervention

period, 2101 (98.5%) had an ESI-level assigned in triage. Most often, nurses classified 1,217

(57%) of patients as ESI-level 3. Next, 441 (20.7%) patients ranked ESI-level 4, followed by

393 (18.4%) of ESI-level 2 patients. Least frequent were ESI-level 5 patients, 33 (1.5%) and

ESI-level 1 patients, 17 (0.8%). Figure 2 represents ESI-levels for patients who arrived at the

ED between 2 p.m. and 10 p.m. during pre- and postintervention periods.
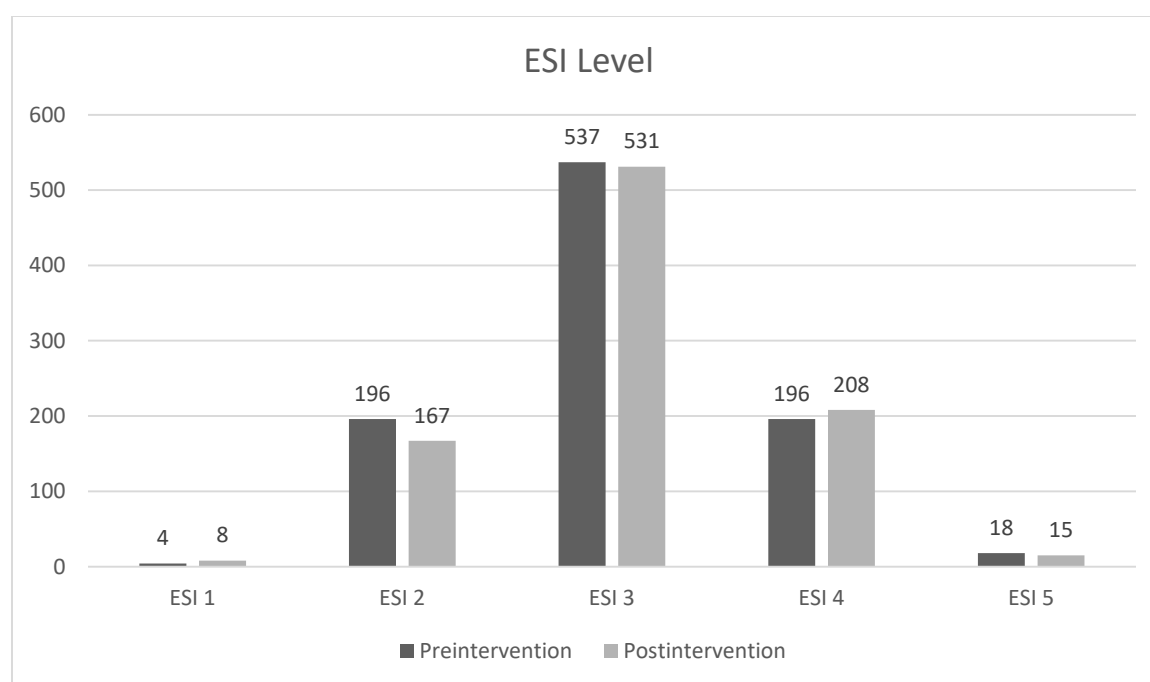
Figure 2. ESI Levels, 2 p.m. to 10 p.m. ESI = Emergency Severity Index.

Measurable Outcome: Median Door-Provider Time

The median door-to-provider time on Sundays and Mondays during the preintervention

phase was 29 minutes and 41 seconds (Table 1). Median door-to-provider time on Sundays and

Mondays from 2 p.m. to 10 p.m. was 46 minutes and 57 seconds (Table 2). In comparison to the

24-hour period, patients waited for initial medical screening on average an additional 17 minutes

and 16 seconds during the busiest time in the ED, between 2 p.m. and 10 p.m.

The median door-to-provider time on Sundays and Mondays during the team triage phase

was 19 minutes and 36 seconds (Table 1). Median door-to-provider time on Sundays and

Mondays from 2 p.m. to 10 p.m. was 10 minutes and 43 seconds (Table 2). In comparison to the full 24-hour period, patients wait on average of 10 minutes and 33 seconds less during the busiest time, between 2 p.m. and 10 p.m., for initial medical screening while a provider is in triage.

Table 1

Door-to-Provider Time

		Preintervention	Postintervention
N	Valid	1871	1936
	Missing	265	197
Mean		0:49:41	0:32:37
Median		0:29:41	0:19:36
Std. Deviation		0:57:43	0:47:15

Table 2

Door-to-Provider Time 2 p.m.-10 p.m.

		Preintervention	Postintervention
N	Valid	837	888
	Missing	131	62
Mean		1:08:00	0:20:29
Median		0:46:57	0:10:43
Std. Deviation		1:10:36	0:27:51

Measurable Outcome: Median Length-of-Stay

The median LOS on Sundays and Mondays was 3 hours, 36 minutes, and 52 seconds (Table 3). From 2 p.m. to 10 p.m., the median LOS was 3 hours and 40 minutes (Table 4).

Patients who came to the ED during this eight-hour period spent an additional 3 minutes and 48 seconds in the department.

The median LOS on Sundays and Mondays during the postintervention phase was 3 hours and 27 minutes (Table 3). The median LOS during the PIT time was 3 hours and 29 minutes. Patients who came to the ED on Sundays or Mondays between 2 p.m. to 10 p.m. waited on average an additional 2 minutes for discharge or admission to the hospital in comparison to the 24-hour period (Table 4).

Table 3

Length-of-Stay

	Preintervention	Postintervention
N Valid	2116	2109
Missing	20	24
Mean	3:59:39	3:47:02
Median	3:36:52	3:27:00
Std. Deviation	2:24:07	2:24:04

Table 4

Length-of-Stay 2p.m.-10 p.m.

	Preintervention	Postintervention
N Valid	956	936
Missing	12	12
Mean	4:06:36	3:48:38
Median	3:40:00	3:29:00
Std. Deviation	2:31:48	2:35:57

Measurable Outcome: Left Without Being Seen Rate

During the preintervention phase, 2.6% (55 patients) left the ED without medical screening on Sundays and Mondays, and 1.3 % (28 patients) left against medical advice (AMA). In comparison, on Sundays and Mondays between 2 p.m. to 10 p.m., 4.3% (42 patients) left the ED without medical screening and 1.4% (14 patients) left AMA. See Table 5 for complete breakdown of patient disposition.

During the postintervention phase, 0.9% (20 patients) left the ED without medical screening on Sundays and Mondays and 3.2% (68 patients) left AMA. In comparison, on Sundays and Mondays between 2 p.m. to 10 p.m., 0.7% (7 patients) left the ED without medical screening and 3.7% (35 patients) left AMA (see Table 5 for complete breakdown of patient disposition). During the PIT time 0.2% fewer patients LWBS.

Table 5

Disposition, 2 p.m. – 10 p.m.

Disposition	Preintervention		Postintervention	
	Frequency	Percent	Frequency	Percent
Admitted Inpatient	198	20.5	126	13.3
Expired	1	.1	2	.2
Home Health Service	0	0	3	.3
Home, Self-Care	663	68.5	735	77.5
Hospice, Home	0	0	1	.1
AMA	14	1.4	35	3.7
LWBS	42	4.3	7	.7
Still a Patient	0	0	1	.1
Xfer Acute Care	11	1.1	11	1.2
Xfer Court/Law	9	.9	6	.6
Xfer Inpatient	1	.1	2	.2
Xfer LTC Hospital	2	.2	.2	97.7
Xfer Psychiatric	12	1.2	5	.5
Xfer SNF	9	.9	9	.9
Xfer to Cancer Center or Children's Hospital	1	.1	0	0
Total	968	100.0	948	100

Note: AMA = against medical advice; LWBS = left without being seen; LTC = long term care; Xfer = transfer; SNF = skilled nursing facility.

SECTION FIVE: DISCUSSION

The purpose of this project was to evaluate if a provider in triage would decrease median door-to-provider time, median LOS, and LWBS percentage in comparison to traditional triage methods. Improving benchmark times in the ED remains of utmost importance and is essential in providing high quality care (Scrofine & Fitzsimons, 2014). Failure to decrease ED overcrowding may have detrimental consequences for patients who have extensive wait times to medical screening, since many EDs have reported unfavorable patient outcomes due to delay in

treatment (Scrofine & Fitzsimons, 2014). Negative financial impacts of unmet benchmarks are associated with decreased patient satisfaction from ED patients (Lauks et al., 2016) and discharged in-patients who were unhappy with their ED visit (Wiler et al., 2015).

The number of patients who presented to this ED prior to implementation of team triage is comparable to the number of patients who underwent team triage during the following year, while an APP triaged alongside the RN for 8 hours and during times of traditional triage on Sundays and Mondays. Patient acuity, as determined by ESI levels, and patients ages are also similar during pre- and postintervention periods; thus, comparison of benchmarks seems meaningful. The median door-to-provider time improved by 10 minutes and 5 seconds during the 24-hour periods and by 36 minutes and 14 seconds between 2 p.m. and 10 p.m. Thus, median door-to-provider time significantly decreased and is below the 20-minute benchmark at time of post-intervention analysis. The overall median LOS improved by 9 minutes and 52 seconds. The median LOS during with a PIT shortened by 11 minutes. While the median LOS has improved, it remains higher than national and state averages (Hospital Compare, 2015). The most significant findings were the reduction of LWBS rates by 0.7% (in a 24-hour period) and 3.6% (8-hour PIT period). LWBS rates postintervention are below the national and state average times (Hospital Compare, 2015).

Limitations. APPs assigned to triage reported they often went to the main ED to perform procedures, such as extensive suturing and incision and drainage upon request of ED physicians. It is uncertain if there was a negative effect on the door-provider-times due to APPs being periodically away from triage, since no logging of this time occurred. Lack of RN and ED technician staffing to initiate lab draws and medication orders in triage may also have impacted

the LOS times adversely; although, radiology technicians and lab technicians initiated orders for

patients in the waiting room as time permitted. In addition, the author reported LOS for

discharged, admitted, and transferred patients as LOS as a single interval. The Hospital

Compare website (2015) lists these times separately; therefore, readers can not draw direct

parallels from this website for the above reported benchmark times. Another limitation was the

brief, 8-week period for pre- and postintervention data collection during late summer and early

fall. Historically, more ED visits ensue during fall and winter months, thus evaluating the team

triage model during times when increased crowding occurs maybe more beneficial.

Implication for Practice

This scholarly project has recorded improved ED benchmark times by placing a provider

in triage. Reduction of benchmark times corresponded with the findings of Spencer et al. (2019),

who also made advancements through similar intervention. As expected, door-to-provider times

improved considerably. Although reduced, median LOS times remain above average. Thus,

implementing a true team triage model with blood draws and expansion of point-of-care testing

during triage, as discussed by Scrofine & Fitzsimons (2014), may further reduce LOS times.

RNs take a class prior to taking on triage assignments, but these educational sessions do not

cover the concepts of team/PIT. Therefore, adding expectations and RN roles to the triage class

may strengthen teamwork among APPs, RNs, and ED technicians and could lead to additional

improvements.

Opportunities for process improvements and further research surfaced throughout the

course of this evidence-based scholarly project. As mentioned by Wiler et al. (2015), exploring

facility wide causes of ED overcrowding outside the ED is beneficial in curtailing benchmark

times. Therefore, individual department leaders from lab, radiology, transportation, and inpatient units could explore how their processes effect ED LOS and pursue potential advances in current practice. Furthermore, this project did not focus on the impact of a PIT on specific ESI levels, so narrowing the focus may bring about additional ideas. A coincidental finding of this project was the increase of patients who left AMA. Nurses or students at this or other EDs may conduct further inquiry to explore a possible correlation of PIT and AMA rates, or to identify other causes of the surge in AMA numbers.

Sustainability

Due to benchmark improvements derived from placing a PIT, the facility will continue to staff triage with an advanced practice provider (APP) on Sundays and Mondays from 2 p.m. to 10 p.m. Even before project completion, the medical director asked APPs to cover additional triage shifts on all Tuesdays from 2 p.m. to 10 p.m. during the month of October due to increased patient census. Furthermore, the ED EHR, MEDITECH®, will undergo a significant upgrade in December. Such updates have historically slowed patient throughput at this medical center. Thus, the provider staffing agency approved funding to add a PIT during the week of MEDITECH® upgrade. Moreover, the provider staffing agency hired an additional nurse practitioner on an as-needed basis. The position is likely to change to a full-time slot since plans are underway to utilize triage providers more frequently. Continued monitoring of LOS, door-to-provider times, and LWBS rates in relation to cost of additional staffing will provide further details on long-term cost effectiveness and sustainability.

Dissemination Plan

This project took place at an academic medical center. The facility's research council and institutional review board (IRB) granted permission to initiate PIT/team triage after a proposal presentation. Council members requested a report of findings upon project completion. Once research council dates become available, a date for presentation will be set. In addition, the project leader is planning discussion of key findings during an upcoming ED staff meeting. This is especially important since ED nurses are stakeholders who had to change their triage process during the intervention phase.

Utilizing the PIT/team triage concept may bring about numerous benefits for EDs in general. However, a comparison of data derived from this and similar projects is difficult, since there is a lack of common study methodologies (Ming et al., 2016). Therefore, a manuscript for possible publication in the *Journal of Advanced Emergency Nursing* is in development in hopes to create awareness amongst nurses, nurse leaders, and nurse practitioners who are likely to lead comparable endeavors. Other ED nurses, such as directors, managers, and nurse educators, may also find an interest in reducing ED overcrowding utilizing this or parallel strategies. Thus, a poster presentation at the Emergency Nursing Association 2020 convention is under consideration to present findings and call for strategies to standardize terminology for better comparison of project outcomes.

Conclusion

Improving benchmark times in EDs requires a team approach. Results of this evidence-based scholarly project illustrated how a single intervention, placing a PIT, brought about noteworthy progress in one ED. Internal causes of ED crowding are multifaceted and require a

system-wide approach. Therefore, leaders should not limit improvement efforts to the ED.

Finally, until law makers address external factors of ED overcrowding, such as a lack of primary

care access, unavailability of affordable, high-quality health insurance, and misuse of EDs, the

problem will remain. Nurses have the knowledge, drive, and compassion to positively influence

this, and other healthcare inequalities throughout the world.

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Appendix A

Evidence Table

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Article 1 Scrofine, S., & Fitzsimons, V. (2014). Emergency department throughput	To improve patient satisfaction, decrease waiting times, improve clinical care, and decrease lost revenue from patients leaving without treatment.	Total number of patients visiting the ED annually. Pre-intervention 19,707 patients in 2011. Beginning of intervention in 2012, 22,721 patients. Full year of interventions 2013, 23,324 patients.	Pre-and postintervention study. Utilized framework Kotter's 8-step model for change.	Patients who left without treatment nearly 50% decrease, therefore, significant decrease in lost revenue. Press Ganey patient satisfaction score 15% increase. Decrease in waiting times 40%.	Level 3: pre-and post-intervention-controlled trial. No randomization.	The authors did not note limitations. Of consideration is, the study was only conducted in one, free-standing ED. Factors such as prolonged waiting from decision-to-admit time to patient leaving the ED and other macrosystem	Yes: This article shows significant improvement in ED benchmark times post-intervention. Although, no providers in triage (PIT) were used as intervention, supportive evidence of increasing NP

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				Satisfaction in nursing care 32% improvement. Throughput metrics improvements: Arrival-to-triage time 40% decrease. Arrival-to-bed time 61% decrease. Arrival-to-discharge time 8% decrease.		slowdowns therefore were not a factor in benchmark times.	and PA hours to improve patient flow was noted. In addition, other successful interventions for consideration have been discussed.

Article 2 Hayden, C., Burlingame, P., Thompson, H., & Sabol, V. K. (2014). Improving patient flow in the emergency department by placing a family nurse practitioner in triage: A quality-improvement project.	To improve front-end operations by reducing LWBS rate to 2% (national benchmark) To fully appreciate the financial and operational impact additional ED visits and hospital admissions resulting from a decreased LWBS percentage could have.	The sample consists of 22,942 ED patients: Total number of patients 11,463 pre-implementation 6,824 females, 4,639 males ESI levels: 1 -37 2 – 1,280 3 – 7,365 4 – 2,562 5 – 211 Age: <2 y – 593 2-17 y – 1,456 18-65 y – 8,373 > 65 y – 1,041 Number of code/trauma patients: 40/34 Total number of patients 11,480 post implementation 6,928 females 4,552 males ESI levels:	Pre- and postintervention quantitative study, comparing mean and mean ranks on each outcome variable.	Increase of LWBS rate by 0.4%. Decrease in length-of-stay (LOS) by 16.65 minutes. Decrease in mean door-provider time by 23.2 minutes. PIT has a statistical and clinically significant impact on door-provider-time and clinical impact on total LOS. LWBS did not decrease as expected. No significant impact in patient satisfaction. No financial impact	Level 3: pre-and post-intervention-controlled trial. No randomization.	Study was performed at a single ED; therefore, generalization is limited. Understaffing may have impacted results. Limited physician buy-in and support. System barriers.	Yes: This study was aimed at improving LWBS rate by adding advanced-practice providers (APPs) to triage and therefore, is remarkably similar to my proposed project. Although the researchers could not record improvements in LWBS rate, door-to-provider times improved. Considering the study limitations, better results could be achieved by assuring adequate

		1 – 16 2 – 1,201 3 – 6,283 4 – 2,563 5 – 219 Age: < 2 y – 594 2-17 y – 1,650 18-65 y – 7,079 > 65 y – 948 Number of trauma/code patients 16/42		because no improvement in LWBS rate.			staffing, physician-buy- in, and exploring system-wide barriers to change. Evidence supports change.
Article 3 Jesionowski, M., Riordan, J., & Quatrara, B. (2019). Does a provider in triage	To explore how rapid medical evaluation (RME) and RME with PIT	All patients registering in the ED on Mondays during the PIT time.	Prospective 2- group design, pre-RME population served as historical	There were no statistically significant differences in any of the	Level 3: pre-and post- intervention- controlled trial. No randomization	Lack of power analysis to determine sample size. One year between pre-and	Yes: While the authors were not able to show statistically

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and rapid medical evaluation help with left without being seen rates and ED crowding?	affected crowding metrics of door-to-disposition time, ED LOS, and LWBS rates.	Patients requiring mental health evaluations where excluded. Pre-RME sample: 1,417 patients, average age 41 93.8% non-Hispanic 66% White 51.6% female Post-RME sample: 1,469 patients, average age 42 93.7% non-Hispanic 65.3% White 54.6% female RME with PIT sample:	control group, and postintervention groups included both RME with and without PIT. Group comparisons of crowding metrics included pre- and post-RME with and without PIT.	crowding metrics for the pre-RME ESI 3 group compared to the post-RME group. No statistical differences in the LWBS rate. No statistical differences in the ED LOS rate for discharged and admitted patients. Decrease in door-to-disposition time for ESI 5 patients by 59 minutes		post-RME analysis may threaten internal validity. Only one study site, therefore, limited generalization. Data collection on only eight days. Staff may not have gained fluency in new workflow. EHR had limited capability in capturing workflow.	differences in most variables, improvement of LOS in ESI level 5 patients was statistically significant and can lead to overall decrease in LOS. Therefore, RME with PIT may be useful for further exploration. This is especially true since the PIT in this study was a resident who had to collaborate

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		714 patients RME without PIT: 755 patients		and 21 seconds. In post-RME comparison, no statistical difference in LWBS was found having PIT or no PIT.			with the attending physician. It is speculated a NP who can independently practice can increase benchmark times because no physician collaboration is needed.
Article 4 (Spencer, Stephens, Swanson-Biearman, & Whiteman, 2019). Health care provider in triage to improve outcomes.	To improve the quality of care provided in the ED as measured by decreased ED wait times, decreased number of patients who	Pre-implementation 28,598 ED visits. Post-implementation 25,577 ED visits.	Pre- and postintervention quantitative study. Evidence -based quality improvement design.	Improved throughput metrics and patient satisfaction in the ED. Door-to-provider time decreased from 56	Level 4: pre-and post-intervention-trial. No randomization or control.	Study was conducted at a single institution. Times for LOS may have been skewed by boarding. Unexplainable patient volume	Yes: The study purposes are like those of the proposed project. ED benchmarks have been improved to acceptable

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	LWBS, and improved patient experience.			minutes to 13 minutes. Patients who LWBS decreased from 12% to 1.62%.		during the implementation time. Practice efficiency varies by provider.	levels. A PIT was used as intervention to improve LWBS and LOS.
Article 5 Yarmohammadian, M. H., Rezaei, F., Haghshenas, A., & Tavakoli, N. (2017). Overcrowding in emergency departments: A review of strategies to decrease future challenges.	To present strategies with a key role in the improvement of patient flow, delay in service, and overcrowding of the EDs.	32 articles fulfilled inclusion criteria.	Computerized database search for articles utilizing keywords: "ED", "overcrowding", "triage", "patient acuity", "hospital emergency services", "emergency room", "LOS", "patient navigation,",	Streaming: Patient flow after triage, most typical method is fast track. Strategies of throughput should focus on patient acuity, prolonged ED evaluations, inadequate inpatient bed	Level 5: Systematic review of descriptive studies.	Only articles in Persian and English were included. Possible information bias due to misclassification of main concepts. Selection and publication bias to be considered.	Yes: The authors acknowledge that ED overcrowding is multifactorial and depends on both, factors within the ED (microsystem) and hospital factors (macrosystem). Advantages

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
			"ED patient journey", "ED patient flow", "ambulance diversion", "emergency outpatient unit", "patient safety".	capacity, shortage of staff, problems with access to on-call specialists, use of ED by patients who have no alternative to healthcare. Fast track: Priorities mostly established by individual hospitals. Team triage: Most cost-effective when utilized			and disadvantages of various strategies to prevent or remedy ED overcrowding are discussed. Some strategies are already in use at the study site; however, effectiveness of individual strategies have not been evaluated. Since reviewed literature supports overcrowding reduction strategies, they

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				during times of higher ED patient volume. Development of triage systems: Medical Emergency Triage and Treatment System protocol in Sweden determines priority level. Adaptive Process Triage or nurse/emergency physician triage and Manchester			should be further explored at the study site.

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
				Triage Scale. Application of these systems increases patient safety. Reverse triage: Safe, early discharge of hospitalized in-patients. Telephone triage after hours: EDs, ambulance, and general practices. Point-of-care testing:			

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
				Significant reduction in turnaround time for lab tests Nurse-requested x-ray has been piloted in some hospitals. Ideal ED patient journal models can support patient flow by utilizing resources outside the ED.			
Article 6	To evaluate	168 patients:	Hypothesis	Actual wait	Level 4:	Study hospital	Yes:

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Davenport, P. J., O'Conner, S. J., Szychowsky, J. M., Landry, A. Y., & Hernandez, R. (2017). The relationship between emergency department wait times and inpatient satisfaction	whether a patient's actual and perceived wait time in the ED significantly influences that patient's subsequent inpatient satisfaction. To determine whether shorter stay patients view their ED wait times as significantly different from those with longer hospital stays. To examine the	91 males 77 females Age range 21-95 year mean 68.7 years. Mean LOS 2.6 days. Median LOS 2.0 days. Mean ED time 4.07 hours. Discharged from: 58.9% progressive care unit. 32.7% two medical surgical units. 4.8% from intensive care unit.	testing.	times in the ED did not predict inpatient satisfaction. Reduction in actual wait times and perceived wait times are associated with higher ED patient satisfaction. Actual wait times in the ED is not a predictor of inpatient satisfaction.	Correlational design.	does not typically board patients to be admitted in the ED. Findings more pertinent to community hospitals versus larger hospitals. Small sample size. All patients who completed HCAHPS survey had to be excluded from the study, since the survey can't be altered. ED patient acuity was not considered. ED wait time	Since wait times were associated with ED patient satisfaction, interventions to reduce ED wait time should be implemented.

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
	relationship between ED satisfaction and inpatient satisfaction.	3.0% from mother-baby unit. One from ED.				may be influenced by staff communication. No attempts to measure this variation. Measures to improve wait time wear underway during study period.	
Article 7 Franklin, A., Gantela, S., Shifarraw, S., Johnson, T. R., Robinson, D. J., King, B. R., ... Okafor, N. G. (2017). Dashboard	To build a suite of dashboard visualizations to improve situation awareness through ready perception key factors	Physicians, nurses, and advanced practice providers (APPs) at three different hospitals within the Gulf Coast region.	Observation of workflow. Survey and interview with physicians, nurse, APP, and administrators pre-and post-dashboard implementation.	Novice users reviewed each patient symbol on the line. More active users utilize summary values on top of the screen.	Level 6: Single descriptive study.	Situational awareness is difficult to measure in real world environments. Tools to measure awareness require work	No: The study results are not clearly defined and appear to be based on opinion rather than on survey and interview results.

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visualizations: Supporting real-time throughput decision-making.	(adherence to care time threshold). To support improvements in comprehension regarding the status of the department and its implications of care (recognizing bottlenecks). To aid in decisions making through the projection of current state into action (change in process to			Authors feel that visual representation of entire ED allows providers to make more appropriate decisions. Situational awareness allows for rapid interventions when pre-determined care targets are not met.		interruptions. Post-task completion assessments are difficult to assess in real-world environment.	Survey and interview results are not addressed. While I feel that a life dashboard has value in improving ED benchmark times, I feel this study did not add convincing evidence.

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		improve flow).					
Article 8 Wiler, J. L., Welch, S., Pines, J., Schuur, J., Jouriles, N., & Stone-Griffith, S. (2015). Emergency department performance measures updates: Proceedings of the 2014 emergency department benchmarking alliance consensus summit.	To review and update key definitions and metrics for ED performance and operations.		Non-profit organization members met to identify industry best practices. Benchmark summit utilizing modified Delphi method. Participants reviewed definitions prior to meeting, then made definition and metrics recommendations based on consensus.	A comprehensive dictionary of ED terminology related to ED performance and operations was developed. Definitions were harmonized with performance measures set forth by the Centers for Medicare and Medicaid Services	Level 7: Expert opinion.	Definition development by consensus. Conference participants were a non-random sample; open to selection bias.	Yes: Good explanation of need for standardization of performance measures. Standard terminology will be helpful when used in scholarly project. Good to use standardized terminology when considering publication.

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				(CMS). Factors that are internal to an ED and hospital can be measured through institution-specific surveys. External factors are outside of the control of any specific ED, such as health and demographics of community, the structure of its health care delivery system and			

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				staff, and its underlying financial resources. To measure ED performance, internal and external factors should be considered.			
Article 9 Lauks, J., Mramor, B., Baumgartl, K., Maler, H., Nickel, C. H., & Bingisser, R. (2016). Medical team evaluation: Effect on emergency department waiting time and	To assess the effectiveness of an alternate care model, the Medical Team Evaluation (MTE) concept on door-to-doctor time and ED	Pre-study: N = 13,120 Median age 52 6887 males 121 ESI level 1 3115 ESI level 2 5867 ESI level 3 3728 ESI level 4	Pre-post interventional study.	Door-to-doctor time decreased by 30 minutes. Improvement was greater for discharged patients (36 minutes) in comparison	Level 4: pre-and post-intervention-trial. No randomization or control. .	Not generalizable due to single study at one hospital. No randomization or control. Multiple change strategies introduced at the	Yes: Although based on this article, it is difficult to determine which intervention improved benchmark times, it

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length of stay	LOS.	289 ESI level 5 Post-study: N = 13,120 Median age 51 6828 males 124 ESI level 1 3214 ESI level 2 5768 ESI level 3 3725 ESI level 4 289 ESI level 5		to admitted patients (24-minute decrease). Best time reduction for ESI level 4 patients. Longest wait times for ESI level 5 patients. Overall median LOS significantly increased from 3.4 to 3.7 hours. Increase in LOS for all ESI levels, except ESI level 5 patients.		same time; therefore, difficult to discern which intervention brought about improvement. Shift in ESI categories: Training in MTE could have reduced under triage. Physician in triage could have led to higher ESI level assignment. MTE was utilized for 11 hours per day. Data was reported for 24-hour periods.	appears that MTE was associated with improvement in door-doctor times. While the proposed project does not include MTE as an intervention, a provider in triage will be utilized. Therefore, this evidence should be beneficial.

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						ED census was not collected. Therefore, variations due to census could not be corrected. Unable to discern which patients were directly discharged by the MTE.	
Article 10 Wallingford, G., Joshi, N., Callagy, P., Stone, J., Brown, I., & Shen, S. (2018). Introduction of a horizontal and vertical split flow model of emergency	To evaluate effectiveness of implementing a vertical workflow	Out of 20,460 patients with Emergency Severity Index (ESI) 3, 2701 (sample) were triaged to vertical flow. 2701 patients were younger in comparison	A 6-month retrospective pre-and postintervention study.	Findings indicate significant decrease in primary outcome measure: total LOS for ESI 3 patients triaged to vertical flow	Level 3: pre-and post-intervention-controlled trial. No randomization.	Age bias: A younger population was triaged to vertical flow, possibly because immobile patients did not meet inclusion criteria.	Although the article does not discuss the use of a PIT, there is a thorough explanation of vertical flow. A PIT at the hospital could assist differentiating

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department patients as a response to overcrowding.		to control period (43 years versus 52 years, $P = 0.00$)		area = 270 minutes in comparison to ESI 3 patients in control period LOS = 384 minutes.		Study performed in an already functional ED; therefore, other factors increasing LOS exist and affect patient flow. Skepticism by staff could have increased LOS.	between ESI 3 patients to be treated in the rapid assessment zone (RAZ) (similar vertical flow) versus main ED.
Article 11 Weiss, S. J., Rogers, D. B., Maas, F., Ernst, A. A., & Nick, T. G. (2014). Evaluating community ED crowding: The Community ED Overcrowding	To identify valid variables that correlate with ED crowding. To determine a model that could be used to accurately reflect the degree of ED	Convenience sample of 13 community hospitals in California. 30,000-67,000 annual ED visits. 64-310 licensed beds. 26-34 licensed	Correlational design	Multiple variables are associated with ED crowding. 90% of ED crowding can be explained by: 1. ED patients to	Level 4: Cohort study	Limited external validity due to study setting (only community hospitals). Definitions used as study variables. Data collectors received a term	Yes: This study discusses the most important variables of ED crowding. In addition, it explains how these variables are used to calculate either

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Scale study	crowding.	ED beds. 62-310 staffed beds. 5,000-16,000 annual admissions. 7 level 2 trauma centers. 6 hospitals without trauma designation.		ED bed ratio. 2. ED visits/year. 3. Number of patients in waiting room. 4. Longest time an admitted patient is still waiting in the ED, ED visits per year. 5. Number of critical care patients in the ED. CEDOCS scale is 20% more affective in the community hospital		dictionary; however, some terms still could be misinterpreted. Not all variables of crowding were included in the study.	NEDOCS or CEDOCS scores. These indicators reflect crowding conditions in the ED. Utilizing these scales, a numerical value can be given to the concept of overcrowding. While I have never seen these scales before, I was able to locate a calculator on my staffing agency website and feel

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				setting in comparison to NEDOCS.			utilizing one of these scales would be helpful.
Article 12 Burstrom, L., Engstrom, M., Castren, M., Wiklund, T., & Enlund, M. (2016). Improved quality and efficiency after the introduction of physician-led team triage in an emergency department.	To compare efficiency and quality measures before and after changing the triage model (traditional triage vs. physician-led triage).	In 2008 (traditional triage) 20,073 ED visits. In 2012 (physician-led triage) 23,765 ED visits. Same percentage of male and female patients both years. Hospital beds 2008 – 512. Hospital beds in 2012 – 500. No differences in chief	Pre-post interventional study.	Physician-led team triage improved the efficiency and quality of EDs. 38% lower probability of LWBS in 2012, Decreased number of unscheduled returns in 2012. Lower mortality rate within 7 days in 2012.	Level 4: pre-and post-intervention-trial. No randomization or control.	Data recording by different people in 2008 and 2012. Original data recorded on busy workdays, not optimal for data gathering. Different computer systems used for data-gathering.	Yes: The evidence in this article is compelling for initiating the team triage process. Earlier treatment decisions were made with a PIT. It is hoped that earlier decisions will lead to shorter LOS and LWBS during the pilot

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		complaints. 2008 – number of attendances per bed – 104. 212 – number of attendances per bed – 112.		Shorter LOS in 2012. Lower number of patients who LWBS in 2012. Lower number of patients who returned for unscheduled visits in 2012.			project. Of additional interest is that all team members received the same information, which led to better teamwork. It is hoped an increase in teamwork can be replicated during the pilot.
Article 13 Ming, T., Lai, A., & Lau, P. (2016). Can team triage improve patient flow in the	To revamp the triage service of an ED in a district hospital. To determine	58 articles that met grading of recommendations, assessment, development, and evaluation	Feasibility study.	There was no statistically significant or clinically relevant reduction of	Level 1: Systematic review and meta-analysis of evidence from randomized	Small number of studies met inclusion criteria. Team triage is a new concept;	Yes: High level of evidence. The article defines team triage and

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emergency department?	whether ED team triage improves patient flow in comparison with single-nurse triage.	(GRADE) criteria and were identified for full assessment. After exclusions, four articles met inclusion criteria.		LOS and wait time (WT) for all patients in these studies. One death as outcome, suggesting that team triage may reduce mortality.	controlled trials (RTCs).	therefore, not much research was found. Reviewed research did not address performance bias.	presents related research. Findings and described concepts can be further used for literature search. Since team triage was a new concept in 2016, more literature may now be available.
Article 14 Improta, G., Romano, M., Di Cicco, M. V., Ferraro, A., Borrelli, A., Verdoliva, C., ...	To improve the management of patients in the ED: To decrease time in the ED	All charts of patients who visited the ED during study period: 16,563	Pre-post interventional study utilizing Lean Thinking.	Strictly following the theoretical path, choosing suitable tools, and applying	Level 4: pre-and post-intervention-trial. No randomization or control.	The authors don't discuss limitations of this study. Limited external validity due to study setting	Yes: This research using the Lean Method gives various ideas that could be useful for the

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Cesarelli, M. (2018). Lean thinking to improve emergency department throughput at AORN Cardarelli hospital.	prior to patients receiving care. To improve the processes that contribute to the value of the clinical services and to facilitate transitions of patients through the various stages of medical treatment. To eliminate bottlenecks, as well as all activities that generate waste and create queues.			the principles of Lean Thinking to the healthcare processes can increase efficiency of services, reduce waste in terms of waiting time, and improve the quality of the work environments for operators.		(only studied at AORN Cardarelli hospital).	scholarly project and other interventions that could be utilized in conjunction with team triage. Ideas which may be helpful: Organize patients who were triaged by ESI levels after data collection. Improving triage environment in conjunction with team triage may

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							yield additional results. Utilizing a team approach yields results.
Article 15 Reinhardt, M. R. (2017). A systematic approach to evaluation of performance deficiencies in ED triage.	To characterize the problem of extended wait times and patients who LWBS in the ED. To develop potential solutions to long wait times and LWBS rates. To determine whether extended wait	30 charts: Equal number of ESI level 1 and 2 patients. Equal number of charts during peak and off-peak times.	Retrospective chart review. Plan, do, study, act (PDSA) was used as a framework.	There is a correlation between wait times and patients LWBS during hours of peak demand. Both ESI level 1 and 2 patients were seen within the suggested period during nonpeak times.	Level 6: Single descriptive study.	The lack of timely charting may have contributed to a skewing of the time to provider triage.	Yes: Potential solutions to prolonged door-to-provider times were discussed and could potentially be reviewed for application at the study side. While I feel that it is somewhat unrealistic to include ESI

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
	times or patient departures were associated with triage level or time of day.			Delay in door-provider time for ESI level 2 patients, median time 22 minutes during peak times. 5-10 LWBS patients daily.			level 1 patients for comparison of LWBS (ESI level 1 patients too ill to walk out if triaged appropriately), I feel that similar chart reviews focused on ESI level 3 patients could usable results.
Article 16 Morais Oliveira, M., Marti, C., Ramlawi, M., Sarasin, F. P., Grosgurin, O., Poletti, P.-A., ...Rutschmann, O. T. (2018). Impact	To assess the impact of a patient-flow-physician coordinator (PFPC) on the proportion of patients offered	33,605 patients pre intervention. 36,288 patients post intervention.	Pre-post interventional retrospective cohort study.	Reduction of waiting times to first medical consultation by 27.7 minutes. No significant	Level 4 Cohort study.	Non-randomized single-center study. Observed reduction time to first medical consultation maybe	Yes. Although a senior physician was used as PIT in this study, I feel that NPs or PAs can achieve

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of a patient-flow physician coordinator on waiting times and length of stay in an emergency department: A before-after cohort study	medical evaluation within time limits imposed by the Swiss Emergency Triage Scale (SETS) and on patient flow within the ED of a teaching urban hospital.			difference in LOS. No significant difference in LWBS		associated with other factors, not intervention. Impact of PFPC on quality of care is difficult to determine. Cost of intervention has not been evaluated.	comparable results, thus reducing door-to-provider time in triage. Since a senior physician was used as PIT, it is speculated that LOS was not reduced because the physician was not readily available to assist residence with disposition of patients. Since the proposed project will use mostly NPs and PAs as triage provider,

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							it can be assumed that the PIT intervention will reduce overall LOS.
Article 17 Muller, K., Chee, Z., & Doan, Q. (2018;2016;). Using nurse practitioners to optimize patient flow in a pediatric emergency department. Pediatric Emergency Care	To quantify the impact of NPs on two common measures of patient flow (LOS and LWBS).	All pediatric patients who present to the pediatric ED (PED) during the study period.	Retrospective comparison of LOS and LWBS on shifts with and without NPs in the PED.	Shifts which were covered by NPs had shortened the LOS by an average of 19.1 minutes (10%-time reduction). Time reduction was prominent in Canadian Triage and Acuity Scale (CTAS) category 3	Level 4: Retrospective cohort study	Use of administrative databases for review could lead to inclusion of erroneous data.	Yes: Although this study was conducted in a PED only, comparable results can be expected in an ED who sees patients of all ages. Additionally, to reduction of LOS and LWBS are desired results of the above

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
				and 4 patients. A 30% reduction of LWBS patients was recorded on shifts with NPs on duty, reducing the LWBS rate from 3.2% to 1.9%. Modest, however statistically significant reduction in LOS and LWBS during NP shifts.			scholarly project. While NPs and PAs in the project will be added to triage as an intervention, lower acuity patients can be discharged from triage, thus, reduction of LOS and LWBS in the low acuity patients is expected to be similar in comparison to this study.
Article 18	To determine	1659 adult	Prospective	Patients who	Level 2:	Study was	Yes:

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Begaz, T., MD, Elashoff, D., PhD, Grogan, T. R., MS, Talan, D., MD, & Taira, Breena R., MD, MPH. (2016;2017;). Initiating diagnostic studies on patients with abdominal pain in the waiting room decreases time spent in an emergency department bed: A Randomized controlled trial. Annals of Emergency Medicine	the effect of initiating laboratory and imaging studies from the ED waiting room on time in a bed, total ED time, and likelihood of patients leaving before completion of service.	patients who presented to the ED with abdominal pain during the study period. Exclusion criteria: Pregnancy Younger than 18 years Too unstable to return to the ED	randomized controlled trial over a 10-month period. Randomized assignment of rapid medical evaluation versus rapid medical evaluation and initiation of diagnostics from the waiting room.	received rapid medical evaluation and had diagnostics initiated from the waiting room spent an average of 32 minutes less occupying an ED bed. LOS for patients who received rapid medical evaluation and had diagnostics initiated from the waiting room was 44 minutes	One randomized controlled trial.	limited to only adult patients who present to the ED with abdominal pain.	ED provider was stationed in triage to perform medical screening exam and enter initial orders like intervention in proposed scholarly project. Reducing LOS, door-to-provider time, and LWBS rate in ESI level 3 patients could potentially impact overall ED benchmarks in

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
				shorter. 3.5% less patients left before being discharged in the group which received rapid medical evaluation and had diagnostics initiated from the waiting room.			the study facility, given the time it takes to get kidney function results prior to CT scans. Convincing evidence of ED benchmark improvement through randomized controlled trial.
Article 19 Singer, A. J., Taylor, M., LeBlanc, D., Meyers, K., Perez, K., Thode, H. C., & Pines, J. M. (2018). Early	To compare LOS of ED patients receiving point-of-care testing (POCT) at triage vs.	52 ED patients with predefined chief complaints who presented to the ED during study	Prospective observational study with matched controls.	Reduction of total ED LOS in stable adult ED patients by 1 hour when POCT were initiated in triage.	Level 4: Case-controlled trial.	Non-randomization. Potential confounding variables, such as patient age and medical conditions.	Yes: This study showed a reduction with POCT in triage. Therefore, adding a

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point-of-care testing at triage reduces care time in stable adult emergency department patients. Journal of Emergency Medicine	traditional core laboratory testing.	period. Exclusion: Patients who were unstable and needed immediate intervention. Patients with chest pain who needed to be placed directly to ED bed based on EKG interpretation.		Nine patients LWBS all had normal POCT.		Results may not be generalizable to less busy ED times. Hawthorne effect could not be ruled out. Single side study.	provider to triage who could order appropriate POCT, interpret test results, order additional tests which are not nursing protocol, and facilitate discharge or patient placement based on POCT could potentially result in significant decrease of benchmark times. The study

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
							facility utilizes some POCT testing; however, additional POCT should be considered in the future to reduce benchmark times and facilitate patient flow.
Article 20 Jennings, N., Clifford, S., Fox, A. R., & O'Connell, J. (2014). The impact of nurse practitioner services on cost, quality of care,	To provide the best available evidence to determine the impact of nurse practitioner services on cost, quality of care,	14 out of 1013 studies met inclusion criteria: English language Various definitions of nurse	Systematic, two-person review with narrative synthesis and quantitative summary of international evidence and results.	Emergency nurse practitioner service has a positive impact on quality of care, patient satisfaction and waiting	Level 5: Systematic review of quasi-randomized trials and descriptive studies.	Narrative only synthesis of findings. Paucity of available research. Varied definitions of emergency nurse	Yes: This systematic review shows NPs to provide valuable services within emergency care. Although, the

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satisfaction and waiting times in the emergency department: A systematic review. International Journal of Nursing Studies.	satisfaction and waiting times in the emergency department for adult patients. To consolidate past evidence and review new literature.	practitioner: Advanced practice nurse Registered nurse Acute care nurse practitioner Family nurse practitioner Nurse registrar Nurse consultant Nurse practitioner candidate.		times. Decreased return to ED of patients who were seen by NPs 2.3% in comparison to 4.2% of patients who returned after being seen by a physician. No significant difference of missed injuries and inappropriate medical management in patients seen by NPs and		practitioner. Variability of skills and knowledge of emergency nurse practitioners.	synthesis did not specify how NPs reduced wait times and improved patient satisfaction, it can be assumed that NPs can provide expedient, quality care in any ED setting.

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				physicians.			
Article 21 Pierce, B. A., & Gormley, D. (2016). Are split flow and provider in triage models in the emergency department effective in reducing discharge length of stay? Journal of Emergency Nursing	To explore if the split flow model reduces LOS for all ED patients compared with an ED of comparable volume that blends the ED patient population. To explore if adding a PIT enhances the split flow model and has an impact on LOS for all patients.	68,603 patients who were discharged from experimental and control ED in 2014. Exclusion criteria: Patients who LWBS Patients who expired Patients who left against medical advice	Quality improvement project comparing patient LOS between two similar EDs. Control site has traditional RN triage and no split flow. The experimental ED implemented PIT in addition to split flow.	The PIT model enhances patient triage assessment and ED patient flow in general. Split flow model coupled with PIT reduces LOS and other throughput metrics.	Level 3: Controlled trial without randomization.	Difference in providers, different RN work experience and knowledge, different department design between control and experimental ED. Results of a quality improvement project can't be generalized to a larger population.	Yes: Results of this QI project supports the PIT model. While the scholarly project does not focus on split flow, the project side uses RAZ for lower ESI leveled patients while higher ESI level patients are placed in the main ED. Therefore, the experimental ED in this QI

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
							project is similar in set up.
Article 22 Ross, B. (2017). Does a rapid assessment team at triage versus a standard nurse approach improve emergency department quality performance indicators? Emergency Nurse New Zealand.	To assess the effect of a rapid assessment team (RAT) might have on quality performance indicators.	Relevant literature between 2006 and 2016, including peer-reviewed articles, research studies, and grey literature. Inclusion: At minimum one ED quality indicator Publication in English language

18 articles: 15 include | Systematic literature review of relevant literature. | Minimum LOS reduction by 30 minutes using RAT. Reduced ED waiting times. Improved patient flow throughout the ED. RAT is cost effective during periods of high ED census. | Level 5: Systematic review | Lack of randomization of most studies included in this review. No qualitative studies are included in this review. | Yes: Studies reviewed indicate that RAT improves ED quality indicators.

RAT is synonymous to PIT, since a medical provider and nurse form the triage team. The review shows that RAT is cost effective during times of |

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
		LOS 8 include waiting times 7 include LWBS Two articles focused on cost analysis of RAT teams. Three articles focused on mortality.					high ED census. Thus, cost effectiveness is suspected when implementing team triage in this scholarly project.

Appendix B

Chief Executive Officer

Re: Reducing Emergency Department Length-of-Stay and Overcrowding Through Team Triage

Dear Ms. Sizemore:

Please allow this letter to serve as acknowledgment that ███████████ IRB#1 has received and reviewed the information presented at Liberty University and emailed on August 8th, 2019. The ██████████ IRB will defer to the Liberty IRB.

The Institutional Review Board is duly formed and constituted in accordance with FDA regulations. The ██████ ██████ IRB #1 is in compliance with the regulations of the Food and Drug Administration as described in 21 CFR parts 50 and 56, as well as the International Conference of Harmonization (ICH) Good Clinical Practice (GCP) guidelines for IRBs.

Sincerely,

The Medical Center IRB #1

MJ/hea

Our mission is to care for people and improve the quality of life in the communities we serve.

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

July 13, 2019

Kirsten Sizemore
IRB Application 3880: Reducing Emergency Department Length-Of-Stay and Overcrowding Through Team Triage
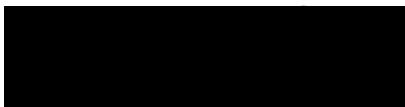
Dear Kirsten Sizemore,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Your study does not classify as human subjects research because evidence-based practice projects are considered quality improvement activities, which are not considered "research" according to 45 CFR 46.102(d).

Please note that this decision only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued non-human subjects research status. You may report these changes by submitting a new application to the IRB and referencing the above IRB Application number.

If you have any questions about this determination or need assistance in identifying whether possible changes to your protocol would change your application's status, please email us at irb@liberty.edu.
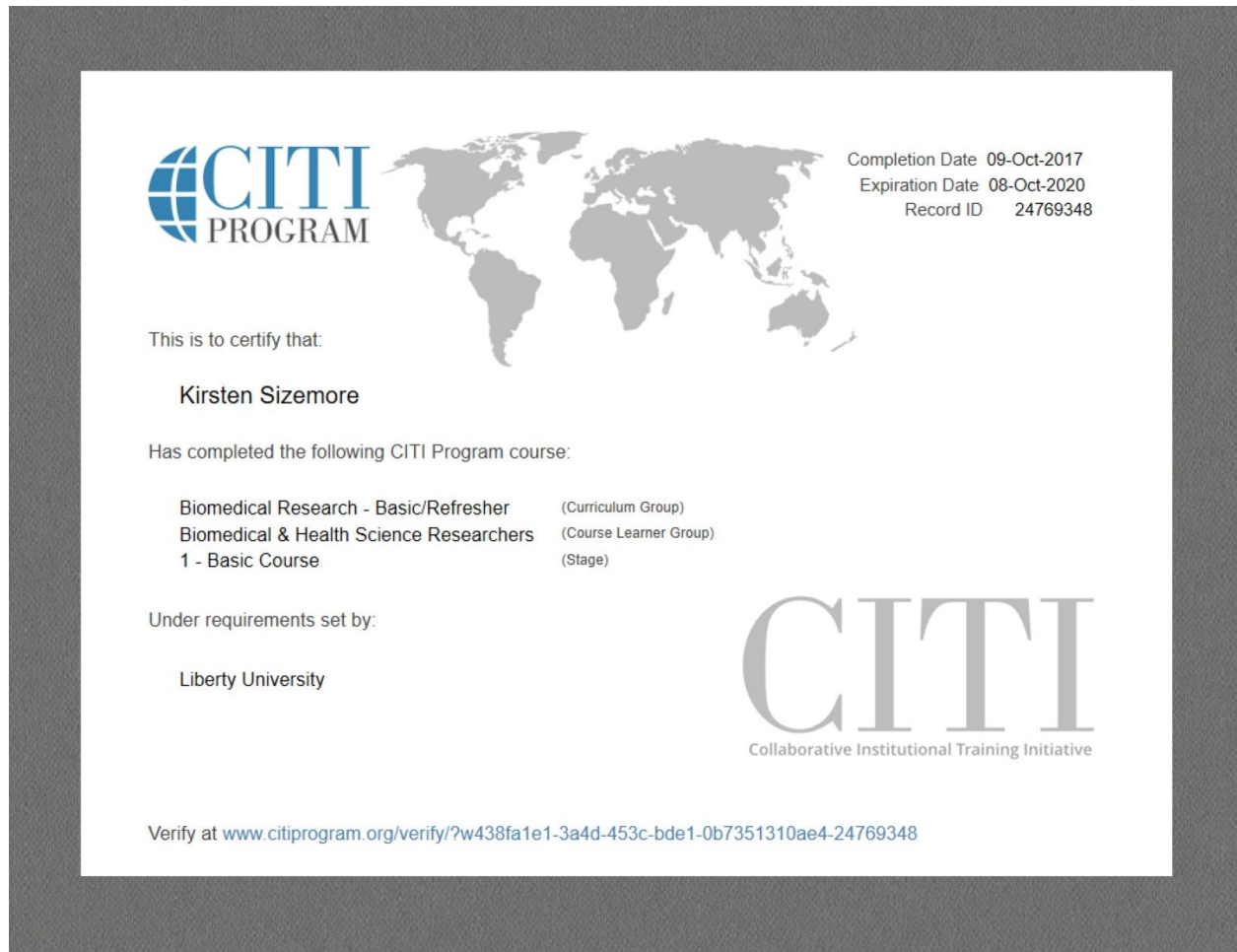
Sincerely,

Administrative Chair of Institutional Research
Research Ethics Office

LIBERTY
U N I V E R S I T Y.

Appendix C

Completion Date 09-Oct-2017
Expiration Date 08-Oct-2020
Record ID 24769348

This is to certify that:

Kirsten Sizemore

Has completed the following CITI Program course:

Biomedical Research - Basic/Refresher (Curriculum Group)
Biomedical & Health Science Researchers (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Liberty University

Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w438fa1e1-3a4d-453c-bde1-0b7351310ae4-24769348

Appendix D

CHIEF EXECUTIVE OFFICER

6/25/2019

Kirsten Sizemore
Liberty University
1971 University Blvd
Lynchburg, VA 24515

Dear Kirsten Sizemore:

After careful review of your research proposal entitled Reducing Emergency Department Length-of-Stay and Overcrowding through Team Triage, we have decided to grant you permission to conduct your evidence-based scholarly project in the Emergency Department at The Medical Center.

☑ The requested data WILL BE STRIPPED of all identifying information before it is provided to the researcher.

☐ The requested data WILL NOT BE STRIPPED of identifying information before it is provided to the researcher.

☑ We are requesting a copy of the results upon project completion.

Sincerely,

Executive Vice President & CNO
Med Center Health
(270)745-1142

Appendix E

Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

██████████ - University of Iowa Hospitals and Clinics
Thu 5/2/2019 8:03 PM
Sizemore, Kirsten
You have permission, as requested today, to review and/or reproduce The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care. Click the link below to open.

The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

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Citation: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223
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Please contact UIHCNursingResearchandEBP@uiowa.edu or 319-384-9098 with questions.