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Impact of Immediate Bedding in the Emergency Department on Length-of-Stay and Left-Without-Being-Seen

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This is to certify that the doctoral study by

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Abstract

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by

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MSN, Walden University, 2011

BSN, Pace University, 2007

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Hospital systems and health care leaders struggle to provide safe and efficient care to patients seeking care in the emergency department (ED). EDs are experiencing a high influx of patients leading to ED overcrowding and causing stress on the department to manage patient flow more efficiently. The inability to manage patient flow properly limits the ability to provide safe, effective, and timely care to patients. Many solutions have been proposed to decrease overcrowding though the main focus of this study was the implementation of a more efficient patient flow strategy, known as immediate bedding. The purpose of this quantitative study was to examine the relationship between the immediate bedding process on ED length-of-stay (LOS) and ED left-without-being-seen (LWBS) incidences. Specifically, the relationship between U.S. EDs who use the immediate bedding process versus U.S. EDs who do not use the immediate bedding process was assessed. A sample size of approximately 18,000, from the NHAMCS of 2015, was evaluated against the variables of immediate bedding, LOS, and LWBS. An independent *t* test and a chi-square test were used to analyze the secondary data sets. The data analysis indicated a statistically significant relationship between immediate bedding and ED LOS; however, there was no statistically significant relationship between immediate bedding and ED LWBS. The results of this study can be used to create new policies and procedures for U.S. EDs while guiding hospital leadership in improving patient flow, patient satisfaction, and patient outcomes. The implications for positive social change include the potential to reduce patient wait times, improve patients' health outcomes, and improve the functionality of EDs.

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Section 1: Foundation of the Study and Literature Review

Every emergency department (ED) across the United States holds the same goal of providing safe, compassionate, and efficient care to each person who seeks medical treatment. These goals are becoming increasingly more challenging due to the growing number of individuals seeking treatment, which leads to a long length-of-stay (LOS) and high numbers of patient abandonment or leaving-without-being-seen (LWBS) in the ED (Jarvis, 2016). To face these challenges, U.S. hospital systems leaders need to implement methods to improve patient flow within the ED, which will decrease overall LOS, improve patient satisfaction, and decrease negative adverse events such as mortality (Jarvis, 2016). In this study, I examined the effect of implementing the patient flow process of immediate bedding on ED LOS and ED LWBS to determine a relationship or lack thereof.

Problem Statement

EDs provide emergency medical services to any person regardless of their ability to pay, socioeconomic status, chief complaint, the ED capacity, or the overall hospital capacity (Moore et al., 2017). Despite the struggles and high influx of patients, EDs are stressed with managing patient flow leading to one of the most significant health care challenges (Kreindler, 2017). According to the Agency for Health care Research and Quality (AHRQ; 2020), in 2008 there were 124.95 million ED visits in U.S. EDs, whereas, in 2016, there were 144 million visits in the ED, which equates to a 16.2% increase and signifies a continual upward trend, increasing to 144.82 million visits in 2017. Though the number of ED visits has increased, the capacity and space of the EDs

have not, placing a burden on resources and leading to adverse patient outcomes (Salway et al., 2017). The effective management of patient flow by ED leadership can positively affect the community's health and significantly reduce ED LOS through optimizing movement within the department and maximizing bed capacity (Elamite, 2018).

Flow within the ED setting refers to the act of moving people, equipment, and information and requires resource supplies to match the demand of those resources (Leviner, 2020). Patient flow begins at the point when a patient enters the ED and continues throughout their hospital stay. ED triage is the first point of intake for a patient into the department, and bottlenecks in this area are linked to increased LWBS numbers, a longer ED patient LOS, and extended door-to-physician time (Wolf et al., 2018). Li et al. (2019) defined ED LWBS as a patient who begins treatment in the ED by discussing their illness with a RN but then leaves before being treated by a physician. Driesen et al. (2018) defined ED LOS as "the total time from the first documented time after arrival at the ED, whether triage or registration, to the time the patient is discharged from the ED" (p. 2).

Prolonged wait times and inefficient patient flow throughout the department are associated with poor quality measures and negatively affect reimbursement rates (Sayah et al., 2014). The Centers for Medicare and Medicaid Services (CMS) has linked financial reimbursement to measures including LWBS and LOS, forcing hospitals to reevaluate their processes and implement improvements (Hwang et al., 2015). CMS defined these measures as "left-without-being-seen" and "median time from ED arrival to

ED departure for discharged ED patients" (Department of Health & Human Services, n.d., p. 1).

Purpose of the Study

This study's results address a gap in the research, explicitly focusing on improvements to the patient flow process in the ED and the relationship with ED LWBS and ED LOS because the association has been minimally studied (Basile et al., 2018). EDs ideally offer prompt medical care for acutely ill patients, ensuring wait times are kept at a minimum by quickly screening the patient upon arrival and designating them to an appropriate location within the ED using a process entitled "immediate bedding" (Flood et al., 2014). Immediate bedding is a process to speed up door-to-physician time, decrease the ED LOS, reduce LWBS incidences, and improve overall patient satisfaction. This process allows the patient to remain in the same treatment area throughout their ED stay except for specified testing procedures and enables clinicians to begin ordering these tests earlier (Scrofine & Fitzsimons, 2014). The purpose of this study was to examine the use of the immediate bedding process on ED LOS and LWBS incidences by comparing data from EDs in the United States who have implemented the process of immediate bedding versus EDs who have not.

CMS quality measures are linked to hospital reimbursement, including ED LWBS and ED LOS, a driving force for hospital leaders to reexamine their processes not to lose money. The Centers for Disease Control and Prevention's (CDC) National Hospital Ambulatory Medical Care Survey (NHAMCS), performed by Rui and Kang (2015), is a survey conducted yearly to collect data on the utilization and provision of hospital

services. The survey is completed annually; however, the more recent data from 2016 and 2017 have inaccuracies and were not used for this study (S. Schappert, personal communication, January 15, 2021). Rui and Kang collected data on the use and delivery of ambulatory care services in hospital EDs, outpatient departments, and ambulatory surgery locations in 2015 (CDC, 2019). The 2015 NHAMCS study randomly selected 457 hospitals though only 377 were eligible due to the CDC's guidelines, and 80 were excluded due to being out-of-scope, clinics, and ancillary services provided in other settings. Of the eligible 377 hospitals, only 277 participated fully, leading to a response rate of 77.8% (Rui & Kang, 2015). Therefore, in this study, I compared ED LOS and LWBS incidences from 277 EDs in the United States based on if the ED uses or does not use the immediate bedding process.

Background

EDs are among the most complex hospital areas, with 70% of admitted patients beginning their hospitalization in the ED (Augustine, 2019). Due to the department's complexity, the patient flow process must be a coordinated effort to improve the patient experience and patient outcomes (Hoag Memorial Hospital Presbyterian, n.d.). Patient flow, especially in a busy ED, is an intricate process, and the mismanagement of this flow leads to an increased ED patient LOS and ED LWBS incidences, which have the potential to lead to an increased number of adverse events and mortality rates (Salway et al., 2017).

The typical ED patient flow begins with the patient's arrival at the front desk; pending registration by a clerk, then the patient waits in the waiting room to be called by

the triage RN (Envision Health care, 2017). Triaging is a process for sorting patients based upon acuity and resources necessary (Ebrahimi et al., 2016). If a patient arrives via the waiting room (as opposed by ambulance), the triage RN is the first medical professional the patient will encounter. The triage RN is responsible for identifying the patient's acuity by performing a focused assessment regarding the patient's current illness and pertinent past medical history (Ebrahimi et al., 2016). Once the triage RN completes the focused assessment, they assign an acuity level that correlates to the amount of time a patient can wait to see a provider (Yiadom et al., 2018).

After triage, the patient is placed back in the waiting area to await placement in a treatment area where the patient must still wait to be assessed by the provider (Envision Health care, 2017). Once evaluated by the provider, the patient must now wait for the primary nurse to carry out the provider's tasks, and the patient must wait for the results of any tests (Envision Health care, 2017). The triage process is long and can often prolong ED LOS and lead to adverse patient outcomes; however, other proven methods, known as immediate bedding or direct-to-room (DTR), are recognized to improve the patient flow process.

The immediate bedding process speeds up the process by having the first person the patient encounters upon arrival be an RN (Basile et al., 2018). This RN quickly determines an appropriate placement area while the registration clerk is simultaneously performing a quick intake. Once the patient is placed in the proper treatment area, the RN in this area completes a full intake asking those questions that would have been initially asked in the triage booth. This process can be performed simultaneously, with the

physician present, to limit duplication of questions and save time. The patient now waits in this area for any further tests or results.

Immediate bedding, DTR, and split-flow are processes whereby patients are placed in an available chair or stretcher in a treatment area within the ED (Marino et al., 2015). Precisely placing the patient in the treatment area allows registration and triage to occur at the bedside, thereby speeding up the time to provider evaluation. The patient remains in a single place for the remainder of their ED stay. For this study, the term immediate bedding was utilized to describe this process; however, it should be noted that U.S. hospitals do not refer to each process the same and have named the methods differently, including DTR, immediate bedding, and split-flow.

The immediate bedding process eliminates the waiting room, decreasing ED LOS and improving patient flow and care; however, this relationship has been minimally studied (Marino et al., 2015). To address this knowledge gap, I conducted this study to evaluate the relationship between the ED immediate bedding process with ED LOS and ED LWBS incidences.

Methods of improving patient flow have been devised to improve patient care quality and speed, including the immediate bedding process. I conducted a review of the existent literature on the topic and selected articles relating to the immediate bedding. The following keyword search terms were used: *LOS, length-of-stay, immediate bedding, direct-to-room, DTR, split-flow, LWBS, left-without-being-seen, patient flow, Emergency Department, ED, ED abandonment,* and *capacity management.* I used the CINAHL,

MEDLINE, ProQuest, and ScienceDirect databases as well as the Thoreau multi-database search tool to locate the literature for this review.

Research Question and Hypotheses

Research Question 1 (RQ1): Is there a relationship between the use of immediate bedding in the ED and the patient's LOS in U.S. hospitals between December 29, 2014 and December 27, 2015?

$H_0$1: There is no statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDS that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$1- There is a statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

Research Question 2 (RQ2): Is there a relationship between the EDs' use of immediate bedding and incidences of patients LWBS in U.S. hospitals between December 29, 2014 and December 27, 2015?

$H_0$2: There is no statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$2: There is a statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

This study's independent variable was immediate bedding, where the effect of implementing the immediate bedding process was examined. The dependent variables were ED LOS and ED LWBS, which were assessed based upon the immediate bedding process. Rui and Kang's (2015) data set refers to immediate bedding as such; however, ED LOS is referred to as "length of visit in minutes" and LWBS incidences as "left after triage" (p. 32)

Theoretical Framework

The theoretical framework of this study comprised Goldratt's theory of constraints (TOC). Since its development and introduction in 1984, TOC has evolved into a globally recognized management philosophy with the understanding that all systems have constraints and require processes of continuous improvement to achieve goals (Ikeziri et al., 2018). TOC is an approach to recognizing limiting factors that hinder a process from succeeding and modifying these constraints until the limiting factor is removed, achieving the end goal (Goldratt, 1990). Goldratt developed this methodology to help organizations understand a problem, develop solutions, and implement methods to ensure success (Mabin & Balderstone, 2003). Through the years, TOC has evolved and developed into a largely used management theory of systematic problem-structuring and problem-solving.

In 1970, Goldratt developed the TOC as a scientific method to improve processes and determined that every system has at least one constraint affecting its success (Cox et al., 2014). There are constraints that must be identified and overcome to progress forward and achieve maximum success (Goldratt, 1990). Performance outcomes within the ED are affected by improper flow management and the TOC approach aids in the improvement process. This mismanagement of flow hinders positive results and places an undue burden on providers and patients alike. Focusing on patient flow management by assessing the constraint and identifying a method of overcoming it, as described by the TOC, can alleviate the burden on ED resources and improve patient outcomes (Envision Health care, 2017).

The one constraint and variable every ED cannot control is the volume of patients who arrive at the ED at any given point in time; therefore, department leadership must focus on the constraint they can control, which is the process of ED flow. EDs across the United States are challenged with overcrowding and increased demand for services due to increased volume (Jarvis, 2016). ED leaders can control and manage departmental flow efficiency by streamlining processes, and the TOC can be used to assist in this process. TOC can assist ED leaders by helping them first understand the constraint (i.e., volume) and then help them develop strategies to increase patient flow.

Nature of the Study

In this study, I employed a quantitative approach, utilizing secondary data from the CDC from the 2015 NHAMCS performed by Rui and Kang (2015). The CDC collects data on the utilization of ED services annually, providing results via the CDC

website available for public use. The 2016 and 2017 data set was unable to be used for this study due to the CDC identifying internal processing issues that calculate the LOS variable. They had not edited the 2016 and 2017 data as of January 15, 2021 (S. Schappert, personal communication, January 15, 2021).

In this study, I used the CDC's secondary data to conduct a retrospective cross-sectional analysis to examine the effect of the immediate bedding process on ED LOS and ED LWBS. A retrospective cross-sectional design was appropriate because it involves utilizing previously collected data about the variables at one point in time (see Bangdiwala, 2019). Cross-sectional designs help identify possible relationships between dependent and independent variables (Wang & Cheng, 2020). Data on the variables of ED LOS and ED LWBS incidences from 267 EDs in the United States who had implemented immediate bedding were compared to ED LOS and ED LWBS to determine if there is a relationship between them. EDs located in the United States who responded to the survey and were within the eligibility scope were included in this study despite their size. This quantitative analysis helped define the benefit, or lack thereof, of using the immediate bedding process in the ED based upon the patient outcome variables of LOS and LWBS.

Secondary Data Types and Sources of Information

I obtained the secondary data for this study using the NHAMCS 2015 data set from the CDC. The data from 2015 was the most up-to-date survey with all applicable data. The CDC (2019a) performs a national survey annually to collect data regarding ambulatory care services, including hospital EDs and outpatient departments. The

NHAMCS survey is a national survey that includes 457 total hospitals EDs and outpatient departments, though in 2015, only 377 met eligibility criteria, and only 267 yielded complete responses (Rui & Kang, 2015). The national survey includes explicitly 21,061 patient record forms (PRFs) at a response rate of 77.8%. This data set consists of all necessary variables for this study, including ED LOS, ED LWBS, and immediate bedding, to obtain a valid and effective answer to the research questions.

Literature Review

Introduction

Hospital administrators are faced with the dilemma of managing the influx of patients who visit EDs while ensuring patient care is safely delivered. Optimal patient flow within the ED is linked to improved patient safety, outcomes, and satisfaction and employee satisfaction scores (Leviner, 2020). There is a gap in understanding related to the negative effect LWBS and LOS can have on an ED and hospital systems as a whole (Mentzoni et al., 2019). Leadership must examine the throughput process and modify these processes to improve the efficiency and effectiveness in the ED. Though there are studies that examine the effects of implementing an immediate bedding model (e.g., Ioannides et al., 2018; Porter et al., 2018), few studies have examined this relationship with LOS and LWBS.

For this study, I examined articles relating to patient flow and immediate bedding within the ED while preferentially selecting peer-reviewed scholarship. The keyword search terms used were *ED patient flow, ED flow, patient flow, immediate bedding, direct-to-room, split-flow, ED LOS, ED LWBS, ED abandonment, ED wait times,* and *ED*

capacity management. I searched the databases of Google Scholar, CINAHL, MEDLINE, ProQuest, and ScienceDirect, and Annals of Emergency Medicine, as well as used Walden University's Thoreau multi-database search tool. The research reviewed was limited to sources published in the last 5 to 7 years.

Capacity Management and ED Overcrowding

ED overcrowding is a nationally recognized problem affecting hospitals of all types and sizes including community hospitals, academic medical centers, and major trauma centers (Dragan et al., 2017). ED overcrowding is defined as "having more patients than treatment rooms or more patients than staff should ideally care for at one given time" (Erenler et al., 2014, p. 60). Overcrowding leads to unsafe situations as extremely high volume of patients can force the ED to function beyond its capacity.

The national problem of ED overcrowding and misuse has associated consequences including increased mortality, delays in initiation of critical care, low patient satisfaction scores, increased costs, longer wait times to see a provider, and patients leaving without receiving treatment (Yarmohammadian et al., 2017). Factors leading to the overcrowding include lack of inpatient bed availability, increased demand, and increased number of non-urgent visits which all have an effect on the ED system (Ortiz-Barrios & Alfaro-Saiz, 2020).

Causes of ED overcrowding are multifaceted, and it is imperative to understand some of the contributing factors prior to attempting to fix the situation. One of the most important factors is patients seeking treatment with non-urgent complaints which is estimated to account for one-third of the ED population (Erenler et al., 2014; Bahadori et

al., 2018). Many of these non-emergent patients could seek treatment via an urgent care or primary care physician (PCP); however, studies have shown they seek care in the ED due to the convenience of care provided in one location (Van den Heede & Van de Voorde, 2016). The patient does not need to leave the ED to obtain blood work, an x-ray, or CAT scan, all of these studies can be performed in the single location; whereas, when care is provided by a PCP, they normally need to obtain a prescription and go elsewhere for these tests (Van den Heede & Van de Voorde, 2016).

ED overcrowding also has an effect on LOS, LWBS, and patient satisfaction scores and is associated with a high number of inpatient boarders in the department. Inpatient boarders refer to a patient admitted as an inpatient to the hospital but has not received a bed assignment on an inpatient unit (Mohr et al., 2020). This leads to less available space for new incoming patients to the ED causing an extended ED LOS, patients leaving-without-being-seen, and poor patient outcomes (Yarmohammadian et al., 2017).

In 2012, The Joint Commission sets standards for hospitals to manage flow and throughput placing a 4-hour time frame goal for ED inpatient boarding (The Joint Commission, 2013). Due to the variability the Joint Commission has not made this a reportable metric nor is it a requirement though it is a recommended guideline to follow. The Joint Commission aims to improve the care provided to boarded patients as well as the patients seeking treatment within the ED.

Chang et al. (2017) provided insight into the effect ED crowding, and inpatient boarding in the ED have on care quality and patient satisfaction. The authors identified

that many studies have focused on processes and flow; however, very few studies have focused on the root cause of ED crowding, such as a lack of inpatient beds, which is a clear gap in research. Patient boarding in the ED reduces the number of beds available for patients seeking care in the ED. The lack of inpatient beds leads to a higher number of patients in the ED, affecting patient flow, LOS, LWBS, and patient satisfaction scores (Salway et al., 2017).

Overcrowding also has financial implications and consequences associated both in the patient care aspect as well as the high cost of medicine (McKenna et al., 2019). All of these components of ED overcrowding lead to bottlenecks with both ED and overall hospital flow forcing the topic of managing patient capacity more efficiently through the development of patient flow strategies. EDs are challenging and unpredictable areas within the hospital therefore any strategy developed must be modified and tailored to each individual ED.

Impact of LOS

ED LOS is defined as the total time of a patient's stay in the ED beginning from the first documented time of arrival until the time of discharge from the ED (Driesen et al., 2018). An increased LOS has been linked to adverse patient outcomes, decreased patient satisfaction, and treatment delays, affecting hospital reimbursement rates (Mentzoni et al., 2019). An extended ED LOS has been associated with delays in lab testing and results, prolonged wait times for radiology tests and results, insufficient ED staff, and lack of hospital beds (Ortiz-Barrios & Alfaro-Saiz, 2020). Understanding how to best manage these issues are intertwine with the patient flow process.

LOS is proportionate to the ED volume and is affected by the ED's inability to refuse treatment to those seeking it. Due to this, hospital leaders must identify methods to alleviate LOS while caring for all who arrive for treatment to the ED. LOS is a quality measure tracked by CMS, and in a study by Anderson et al. (2020), after implementing a rapid patient flow process, there was a decrease in ED LOS from 203 minutes to 171 minutes. Anderson et al. determined that the physician and RN staffing within the ED remained the same; however, rapid bedding inclusive of modifying beds to a vertical and horizontal approach was implemented. Anderson et al. also found that 81 days postintervention, LOS remained low even when the ED volume spiked.

An additional study conducted by Wallingford et al. (2018) introduced an immediate bedding model utilizing the horizontal and vertical approach, also known as split-flow. They documented a LOS decrease from 384 minutes to 270 minutes post-intervention. Their study did not make any architectural changes but could use the existing structures under modification without adding additional providers. They found the hospital could decrease LOS without experiencing any adverse patient events, though their study was only performed in a single ED over 6 months.

Garrett et al. (2018) attempted to determine if there is a relationship between a vertical flow model approach with ED throughput times. Their study spanned a 12-month timeframe with a total of 222,050 patient visits, with 107,217 patients being preintervention and 114,833 patients postintervention. Their results showed an overall decrease in ED LOS by 17 minutes after implementing the vertical flow model. Garret et al. also showed an improvement in patient satisfaction scores after the implementation.

Researchers continue to study the effect of improving patient flow models on EDs as a whole. Chartier et al. (2016) conducted a study to decrease patient wait time while identifying barriers and strategies in achieving an optimal patient flow model in the ED. They went further in-depth in bed flow and utilization by developing alternative locations for patients who did not require cardiac monitoring and examining bed turnaround time. They determined that when communication strategies were implemented, and other improvements, overall patient LOS in the ED decreased (Chartier et al., 2016).

ED LOS is also associated with increased costs for the patient and hospital. A study by Foley, Kifaieh, and Mallon (2011) estimated an extended ED LOS cost the hospital system over $6.8 million over three years. Not only does an extended LOS cost the hospital but it also limits the number of future patients who can receive treatment. If the department could decrease their length of stay by at least one hour per patient they can effectively increase the number of patients seen annually (Farley & Kwun, 2016).

Impact of LWBS

The CMS has recently linked LWBS rates with hospital reimbursement rates. The Hospital Outpatient Quality Reporting Program is a quality data reporting program that requires hospitals to submit data regarding quality of care measures (CMS, 2020). CMS identified the key measures as “OP-22: Left-without-being-seen,” which must be reported by hospital EDs nationwide (Li et al., 2019). As of 2018, the Hospital Outpatient Quality Reporting Program requires LWBS rates to be below 2% percent, or the hospital will receive a 2% rate reduction (Li et al., 2019).

Extended wait times are linked to patients leaving without receiving treatment due to their dissatisfaction and frustration with the lengthen process (Ortiz-Barrios & Alfaro-Saiz, 2020). This group of patients have long been identified as a high-risk group as many tend to require care by a physician but due to their dissatisfaction do not continue on with the treatment (Pielsticker et al., 2015). The challenge of repeat visits has been shown to be higher in those patients who LWBS as compared to those patients who have completed their ED visit (Zubieta, Fernandez-Pena, & Gomes, 2017). On contrary, some of the patients who leave without being seen have a higher tendency to be admitted with more severe complications which leads to higher costs and poor patient outcomes (Ortiz-Barrios & Alfaro-Saiz, 2020).

LWBS rates range from 1%–10%, depending on the facility, which negatively reflects on the hospital system and ED (Li et al., 2019). Often patients leave without being seen due to long wait times, which is linked to patient flow mismanagement with the department (Leviner, 2020). Despite the recent emphasis on decreasing LWBS rates, very few studies delve deeper into the underlying issues (Li et al., 2019). Patients who leave the ED without being seen are of significant concern for health care providers because research has shown to link LWBS with poor patient outcomes. These poor outcomes are due to the patient not receiving the treatment they intended on receiving, which often leads to avoidable adverse outcomes.

LWBS is also referred to under the terminology of patient abandonment. Patient abandonment is a significant problem throughout U.S. EDs due to the potential to lead to adverse patient outcomes, but EDs have difficulty capturing exact abandonment times

(Geers et al., 2020). Pasupathy et al. (2017) performed a study attempting to understand factors affecting abandonment and average timeframes because ED abandonment has detrimental effects on patient care, the quality of care patients receive, and patient satisfaction rates. Their study showed a mean LOS of 98 minutes in which patients began to abandon treatment but did note that more research was necessary, including other factors stressing the department (Pasupathy et al., 2017).

Use of Immediate Bedding

Flow refers to the movement of a person, a piece of equipment, or information, but health care flow refers to patients' movement through the health care system (Leviner, 2020). Optimal patient flow is linked to quality care as well as improved patient safety and satisfaction. In contrast, poor patient flow leads to delays in treatment and has been linked to adverse patient outcomes (Leviner, 2020). EDs may not have the ability to change their architectural design due to high costs, which reinforces the need to optimize flow using other, less costly methods, including immediate bedding (Easter et al., 2019).

ED leadership must reevaluate their processes, including initial intake processes to determine if modifications can be made to ensure efficiency. Many EDs are still completing the triage upon arrival from an area near the waiting room even though there are available spaces in the ED (Garrett et al., 2018). If a bed or chair are available in the treatment area, the patient should be immediately moved, and the triage process can take place in this location. Triage does not correlate to a location, but a standard set of questions required to understand the severity and acuity of a patient's immediate illness

(Garrett et al., 2018). Hospital leadership should evaluate their front-end processes to ensure timely and safe care is provided in an efficient manner.

A component of the immediate bedding process is modifying the physical areas in the ED by implementing a vertical and horizontal approach to patient flow (Easter et al., 2019). This may seem confusing but is very simple; those patients who can sit will be placed in recliner chairs or regular chairs, and those patients who require stretchers will be provided with such (Wallingford et al., 2017). This allows more patients to be placed in the ED while utilizing the existing space and structure.

Implementing the immediate bedding model, or as some refer to it, the split-flow model, in EDs has been shown by Flood et al. (2016) to decrease door-to-doctor time and overall ED LOS. Ioannides et al. (2018) showed a correlation between immediate bedding and decreased LWBS, which was also linked to minimizing patient harm. Though most patients who leave without being seen have low acuity complaints, there are those patients who cannot wait for treatment, and when they LWBS, they face adverse outcomes.

Another important factor to consider is the psychology of waiting. When a patient must wait in a waiting room it leads to frustration and annoyance as well as a feeling of demoralization (Envision, 2017). Extended wait times are linked to negative patient satisfaction and negative perceptions by the patient (2017). EDs are unpredictable areas and will always have variations; however, if leadership can get a better grasp on the flow, they can decrease these other factors. As Chu et al. (2019) discuss, when patients feel

they are acknowledged they have a higher tendency to accept the process which leads to better patient satisfaction scores and less patients leaving without receiving treatment.

Stress on ED

Several researchers have examined the need to improve the overall state of EDs nationwide because patients are continually demanding more and more from EDs. Though ED demand has increased, the capacity and structure of many EDs have not, placing an undue burden on staff along with hospital resources. It is challenging for hospital leadership to balance the high volume of ED patients while ensuring quality care is provided to all and maintaining high patient satisfaction scores (Kane et al., 2015). Health care organizations have begun applying lean methodologies principles to maximize efficiency while using the least amount of resources. Through the use of different strategies of modifying the patient flow and ED throughput, Kane et al. (2015) identified a 17% decrease in ED LOS and a 73% decrease in door-to-doctor time.

Due to the financial impact on the ED and the impact of community health, health care leaders must understand the factors and barriers that contribute to managing the ED flow more effectively and efficiently. Many patients seek treatment in EDs when they could easily visit an urgent care, which places undue stress on the ED. Chmiel et al. (2016) performed a study in which lower acuity, less sick patients were triaged to a hospital-integrated general practitioner to determine how this affected ED caseload. They identified that some factors for overuse of the ED included lack of insurance and the inability to get in touch with their primary physician. While Chmiel et al. determined there is a decrease in treatment times, diagnostic testing, and cost of the visit when the

patients were triaged to a hospital-integrated general practitioner, there is still a gap in research. This gap concerns the overuse of EDs because their study was only conducted in a single Swiss hospital.

Conclusion

Health care leaders must understand how to manage the flow and capacity of an ED as there are various factors, including LOS, LWBS, patient satisfaction, stress on the department, and patient flow strategies, which place an undue burden on the department. These factors reflect the need to focus on improving efficiency in the department and hospital as a whole. As Pasupathy et al. (2017) explained, ED abandonment, or ED LWBS, has detrimental effects on patient care and the ability of EDs to provide service to patients within an acceptable timeframe; however, the authors also recognized that there is a gap in research on this topic.

Both external and internal variables affecting patient flow and capacity management must be examined to enact health care changes. Controlling inpatient flow directly correlates to ED flow due to the lack of beds available to render care and affecting the number of patients whom LWBS (Chang et al., 2017). Therefore, it is critical to understand both the internal and external factors impacting the flow in the ED.

Definition of Terms

ED acuity: The level of severity of a patient's illness dictating the urgency for a provider to intervene as well as the number of resources necessary to treat (Yiadom et al., 2018).

ED boarder: A patient admitted as an inpatient to the hospital but, due to unforeseen circumstances, has not yet been assigned an inpatient bed, therefore, receiving their care in the ED (Mohr et al., 2020).

ED LOS: The total time of a patient's stay in the ED beginning from the first documented time of arrival until the time of discharge from the ED (Driesen et al., 2018).

ED overcrowding: ED overcrowding is defined as "having more patients than treatment rooms or more patients than staff should ideally care for at one given time" (Erenler et al., 2014, p. 60).

ED LWBS: A patient presents to the ED for evaluation and treatment but leaves before examination by an ED physician (Ioannides et al., 2018).

ED triage: The process of prioritizing while sorting patients seeking care in the ED while considering the number of resources a patient may need and the severity of their complaint (Ebrahimi et al., 2016).

Immediate bedding: The process of registration, triage, bed assignment, and medical evaluation in the same centralized location (Flood et al., 2016).

Left after triage: A patient presents to the ED and is evaluated by the triage nurse but leaves before evaluation by an ED physician (Mataloni et al., 2018).

Assumptions

It is assumed that all hospital EDs use the same or similar standard triage system. If there are different triage systems, this could affect and influence patient LOS and LWBS. Other systems can collect and collate data differently, thereby skewing the results. Due to the use of secondary data, it is assumed that this data is accurate, valid,

and reliable. Lastly, it is assumed that all variables are independent of one another, necessary for statistical analysis.

Limitations and Challenges

Potential barriers and challenges include the limited research on the topic, narrow focus, and possible data access fees. Another obstacle is identifying specific studies examining immediate bedding and direct-to-bed techniques as some studies along with states refer to this technique under different terminology. A significant barrier is the variability and unpredictability of the ED environment, affecting results and outcomes.

One of the most significant barriers identified is the use of different terminology, all of which have the same definition. Rui and Kang's (2015) survey identifies the process as immediate bedding. Still, through research, I have found that different states within the U.S. have coined the process using different terms, including split flow and DTR, though others could. An additional limitation is the CDC's data sets are based upon voluntary survey responses from hospitals. These results have the possibility of being skewed based upon the number of survey responses received.

While performing a literature review and research, a problem arose from the inability to use the 2016 and 2017 data sets due to the LOS variable's inaccuracy. The CDC identified internal processing issues that calculate the LOS variable; however, they have not edited the 2016 and 2017 data (S. Schappert, personal communication, January 15, 2021). The 2018 data has recently been revised and published. Still, the summary table, which provides insight into the sampling frame, study design, and hospitals

included, has not been released (S. Schappert, personal communication, January 15, 2021).

Significance

Hospital administrators and ED leadership must understand the impact flow has on the organization and the consumer. Improving the front-end patient flow processes by implementing immediate bedding can improve the back-end process by decreasing overall LOS (Elamir, 2018). Along with patient care, flow within the ED ensures the hospital receives the highest reimbursable rate by CMS. For every requirement not met, financial reimbursement is decreased by 2% (Department of Health & Human Services, n.d.).

This study's findings can affect positive social change by improving the community members' health and well-being by decreasing the ED LOS and ED LWBS incidences. An extended ED LOS leads to a prolonged diagnosis and has been linked with poor patient outcomes, including death (Marino et al., 2015). When patients leave before beginning treatment, they are placing themselves at risk as they do not receive the proper care, resulting in poor outcomes (Anderson, Pimentel, Golden, Wasil, & Hirshon, 2016).

Conclusion

The management of patient flow within the ED setting is necessary to ensure safe and efficient patient care is administered. An increased LOS and high LWBS incidences have been associated with poor patient outcomes and lower patient satisfaction scores. As Pasupathy et al. (2017) explained, ED abandonment, or ED LWBS, has detrimental

effects on patient care and the ability of EDs to provide service to patients within an acceptable timeframe; however, the authors also recognized that there is a gap in research on this topic. Both external and internal variables affecting patient flow and capacity management must be examined to enact health care changes. Controlling inpatient flow directly correlates to ED flow due to the lack of beds available to render care and affecting the number of patients whom LWBS (Chang et al., 2017). The number of ED boarders also affects patient flow and directly correlates to ED LOS and ED LWBS incidences. These boarders take up very critical and limited space due to variables unbeknownst to the department and leadership. Therefore, it is essential to understand both the internal and external factors impacting the flow in the ED.

Section 2: Research Design and Data Collection

In this study, I examined the implementation of an immediate bedding process in the ED and its effect on ED LOS and ED LWBS. To analyze the data collected on a target population of EDs two quantitative tests were used, an independent *t* test and a chi-square. These EDs responded to the NHAMCS between December 29, 2014 and December 27, 2015. In this section, I discuss the research design, methodology, study variables, data analysis, threats to validity, and ethical considerations.

Research Design and Rationale

This study was guided by the following two research questions and their corresponding hypotheses:

RQ1: Is there a relationship between the use of immediate bedding in the ED and the patients' LOS in U.S. hospitals between December 29, 2014 and December 27, 2015?

H_{01}: There is no statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1 1$: There is a statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

RQ2: Is there a relationship between the EDs' use of immediate bedding and patients' incidences of LWBS in U.S. hospitals between December 29, 2014 and December 27, 2015?

$H_0$2: There is no statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$2: There is a statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

The first research question addresses the effect on ED LOS when the hospital implements an immediate bedding process in the ED. The second research question addresses the impact on ED LWBS incidences when the hospital implements an immediate bedding process in the ED. I evaluated this relationship by reviewing the NHAMCS results of EDs who had implemented the process versus EDs who did not use the process.

The independent variable was the immediate bedding process, whereas EDs were asked to answer the survey question: "Does your ED use immediate bedding?" The results appear as a yes or no. The dependent variables were ED LOS and ED LWBS. ED LOS is displayed a patient's length of visit in minutes and ED LWBS is presented as 0 for no and 1 for yes.

I used the NHAMCS secondary data provided by the CDC to conduct a cross-sectional analysis to examine the effect of the immediate bedding process on ED LOS

and ED LWBS. A retrospective cross-sectional design was appropriate for this study because it involves utilizing previously collected data about the variables at one point in time (see Bangdiwala, 2019). Cross-sectional designs help identify possible relationships between dependent and independent variables (Wang & Cheng, 2020). Using a retrospective analytic approach allows the use of previously collected data to assess the association between variables (Kesmodel, 2018). In this study, I compared the variables of ED LOS and ED LWBS incidences from 267 EDs in the United States who had implemented immediate bedding to ED LOS and ED LWBS incidences from EDs who had not implemented immediate bedding to determine if there is a relationship. A retrospective cross-sectional design allows the researcher to examine the association between an incident or event at a specific point in time which a correlating variable (Wang & Cheng, 2020).

Methodology

Population

This secondary data analysis included the 2015 NHAMCS ED participants. This survey comprised 457 total hospital EDs and outpatient departments; however, only 377 met eligibility criteria, and only 267 provided complete responses (Rui & Kang, 2015). The national survey specifically included 21,061 PRFs at a response rate of 77.8% (Rui & Kang, 2015). This data set contained the necessary variables, including ED LOS, ED LWBS, and immediate bedding, to obtain valid and effective answers to the research questions of this study.

Sampling and Accessibility

The target population included EDs that had implemented the immediate bedding process versus EDs that had not implemented the immediate bedding process. The NHAMCS is comprised of data for patients who visited EDs, exclusive of federal, military, and Veterans Administration hospitals, located within the 50 states of the United States (CDC, 2015). The NHAMCS incorporates a three-stage probability sample design of geography or primary sampling unit, selected hospitals and EDs within the PSU, and emergency service areas (CDC, 2019a).

I collected the secondary data used in this study through the CDC via the NHAMCS data set from 2015 because the 2016 and 2017 data set was incomplete (CDC, 2019a). The information is verified by a trained interviewer who visits the sample facility before survey participation, explaining survey procedures, eligibility, and a plan. Once this process has been completed, a 4-week reporting period is randomly assigned, and data are recorded.

The NHAMCS data set is publicly available, though certain variables are masked for confidentiality, such as patient name (CDC, 2019b). Otherwise, the data set is published for public use and available via the CDC website or the Inter-University Consortium for Political and Social Research. The Inter-University Consortium for Political and Social Research is an international consortium of over 750 academic facilities and research organizations that provide access to data and maintain an archival database of over 250,000 files to aid in research (Regents of the University of Michigan, 2020).

Power Analysis

A power analysis is a method of determining the appropriate sample size applicable to the type of tests performed (Uttley, 2019). Uttley (2019) explained that sample size is an important determinant of effect size. The study will reveal and determine the probability that a significant effect will be discovered and identified.

Related to RQ1, the dependent variable was LOS, the independent variable was immediate bedding, and the statistical test was an independent *t* test. I conducted an a priori power analysis using G*Power 3.1.9.6 (Kyonka, 2019) to test the difference between the means of the two independent groups using a two-tailed test, a medium effect size (*d* =.50), and an alpha of .05. Results showed that a total sample size of 128 participants with two equal-sized groups of $n = 64$ was required to achieve a power of .80.

Related to RQ2, the dependent variable was LWBS, the independent variable was immediate bedding, and the statistical test was a chi-square test. I conducted an a priori power analysis using G*Power 3.1.9.6 (Kyonka, 2019) to test the goodness of fit with a medium effect size (*d* =.50) and an alpha of .05. Results showed that a total sample size of 88 participants was required to achieve a power of .80.

Instrumentation and Operationalization of Constructs

I utilized data from the NHAMCS of 2015 made available by the CDC for this research study. The NHAMCS secondary data set included all variables, including LOS, LWBS, and immediate bedding, which are necessary to analyze the relationships under study. Statistical package for the social sciences (SPSS) was the statistical tool used to

measure the data in an independent *t* test for RQ1 and a chi-square test for RQ2. This data set does include masked variables available upon specific request; however, these masked variables did not apply to this study and would not have affected the results (see CDC, 2019b). Though the survey is repeated annually, the CDC has documented errors, and there is no literature available regarding its validity and reliability. Table 1 shows the NHAMCS survey variables.

Table 1

NHAMCS Survey Variables

Variable	Survey label	Study label	Level of Measurement	Potential Response
Dependent	LOV (length-of-visit)	ED LOS	Scale	Numerical value (in minutes)
Dependent	LEFTAT (left-after-triage)	ED LWBS	Nominal	1 = Yes or 0 = No
Independent	ImBed (immediate bedding)	Immediate Bedding	Nominal	1 = Yes or 2 = No

Note. LOV refers to ED LOS. LEFTAT refers to ED LWBS. ImBed refers to immediate bedding process

Study Variables

Dependent Variables

LEFTAT = Emergency department left-without-being-seen: A patient presents to the emergency department for evaluation and treatment but leaves before examination by an ED physician (Ioannides et al., 2018).

LEFTAT = Emergency department left-after-triage: A patient presents to the emergency department and is evaluated by the triage nurse but leaves before evaluation by an emergency department physician (Mataloni et al., 2018).

LOV = Emergency department length-of-stay: The total time of a patient's stay in the ED beginning from the first documented time of arrival until the time of discharge from the emergency department (Driesen et al., 2018).

Independent Variable

ImBed = Immediate bedding: The process of registration, triage, bed assignment, and medical evaluation in the same centralized location (Flood et al., 2016).

Data Analysis

This study examined the use of the immediate bedding process in US EDs and its' impact on ED LOS and LWBS incidences. The study is a retrospective cross-sectional design utilizing data from the CDC collected at specific points for each hospital during a year-long time frame. The software used for data analysis was SPSS version 27 and G*Power. The statistical analysis for RQ1 is an independent *t test*, whereas RQ2 uses a chi-square test. The CDC conducted data cleaning before publication, and individual data cleaning was completed to remove non-applicable variables, only leaving those being examined.

Analysis Plan

RQ1: Is there a relationship between the use of immediate bedding in the ED and the patients' LOS in U.S. hospitals between December 29, 2014 and December 27, 2015?

H_{01}: There is no statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not

utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$1: There is a statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

RQ2: Is there a relationship between the EDs' use of immediate bedding and patients' incidences of LWBS in U.S. hospitals between December 29, 2014 and December 27, 2015?

$H_0$2: There is no statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$2: There is a statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

The first research question addresses whether there is a relationship between immediate bedding and a patient's length-of-stay. The relationship between the independent and dependent variables was assessed by conducting an independent *t* test.

The second research question addresses whether there is a relationship between immediate bedding and a patient's LWBS incidences. The assessment of the relationship between the independent and dependent variables is completed by conducting a chi-square test.

Threats to Validity

External Validity

External validity is associated with the generalizability of a study and likelihood the effects could occur outside of the study (Khorsan & Crawford, 2014). Due to the secondary nature of this study, a threat is the responsiveness of participants. This survey bases its' results on voluntary involvement of applicable EDs within the United States (CDC, 2019a). The CDC uses a three-stage probability sampling method, limiting the number of suitable EDs for this study (CDC, 2019a). Each ED is randomly assigned a 4-week reporting period, affecting results depending on patient volume during this period.

Internal Validity

Internal validity is the extent of confidence that the causational relationship established in a research study is related and not affected by confounding factors and other variables not inclusive in the research study (Flannelly et al., 2018). Internal validity of any study can be affected by a variety of factors including data collection errors and errors in participant selection (Patino & Ferreira, 2019). Due to the data included in this survey being collected over a 4-week time frame for each ED, the entire survey spans a 1-year time frame for all participants. This longer time frame can affect validity due to maturation and possible organizational improvements (Flannelly et al., 2018).

Ethical Considerations

Due to the retrospective design of this study utilizing secondary data collected by Rui et al. (2015), it does not involve experimentation on live human participants. All data

used for this study were de-identified, eliminating patient identifiers including patient name, birth date, and medical record numbers (CDC, 2019b). The NHAMCS 2015 data set also does not share hospital information or location, which could identify patients involved. This study was approved by the Walden University institutional review board approval 12-18-20-0174645.

Summary

In Section 2, I explained the study design, data collection methods, data analysis methods, and possible threats and ethical considerations. Additionally, a power analysis was performed to determine the smallest sample size to assess the variables' relationship. I also outlined the methodology to conduct the study and is examined with statistical results in Section 3.

Section 3: Presentation of the Results and Findings

The purpose of this study was to examine the process of immediate bedding when used in the ED on LOS and LWBS incidences. In his study, I examined if there was a difference in ED LOS and ED LWBS incidences between EDs that do use the immediate bedding process versus EDs that do not use the immediate bedding process. The NHAMCS secondary data were used while performing an independent *t* test and a chi-square test to answer the following research questions.

RQ1: Is there a relationship between the use of immediate bedding in the ED and the patients' LOS in U.S. hospitals between December 29, 2014 and December 27, 2015?

$H_0$1: There is no statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$1: There is a statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015.

RQ2: Is there a relationship between the EDs' use of immediate bedding and patients' incidences of LWBS in U.S. hospitals between December 29, 2014 and December 27, 2015?

$H_0$2: There is no statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

$H_1$2: There is a statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015.

I completed an independent *t* test for RQ1 because the independent variables were nominal, and the dependent variable was a scale variable. A chi-square test was conducted for RQ2 because both the independent and dependent variables were nominal.

Data Collection of Secondary Data set

I collected the secondary data compilation from the CDC). The data used in this study was from the NHAMCS 2015 data set because the 2016 and 2017 data sets were incomplete (see CDC, 2019a). The data set is verified by a trained interviewer who visits the sample facility before survey participation, explaining survey procedures, eligibility, and a plan. Once this process has been completed, a 4-week reporting period is randomly assigned, and data are recorded.

This secondary data analysis included the 2015 NHAMCS ED participants. The 2015 survey comprised 457 total hospital EDs and outpatient departments, though only 377 met eligibility criteria, and only 267 provided complete responses (Rui & Kang, 2015). The national survey specifically includes 21,061 PRFs at a response rate of 77.8%. This data set contained the necessary variables, including ED LOS, ED LWBS, and

immediate bedding, to obtain valid and effective answers to the research questions of this study.

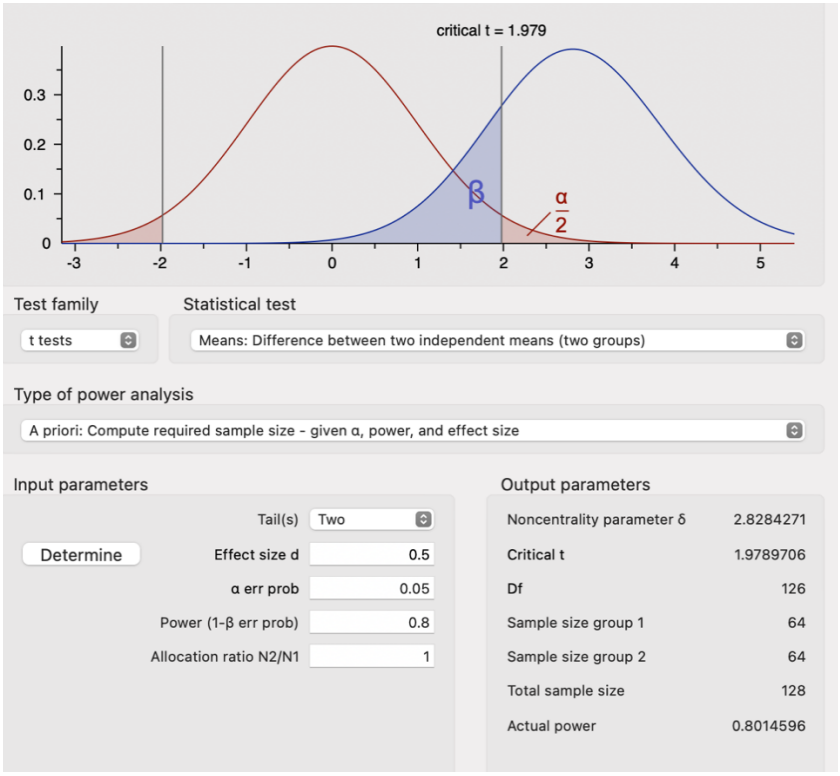
Study Results

G*Power Analysis

I conducted an a piori power analysis using G*Power 3.1.9.6 (Kyonka, 2019) for RQ1 to examine the appropriate sample size. Results showed that a total sample size of 128 participants, with two equal-sized groups of $n = 64$ was required to achieve a power of .80 and detect a medium effect size ($d = .50$) with an alpha of .05. This sample was achievable with the 21,061 PRFs included in the 2015 NHAMCS. Figure 1 depicts the G*Power analysis for RQ1.

Figure 1

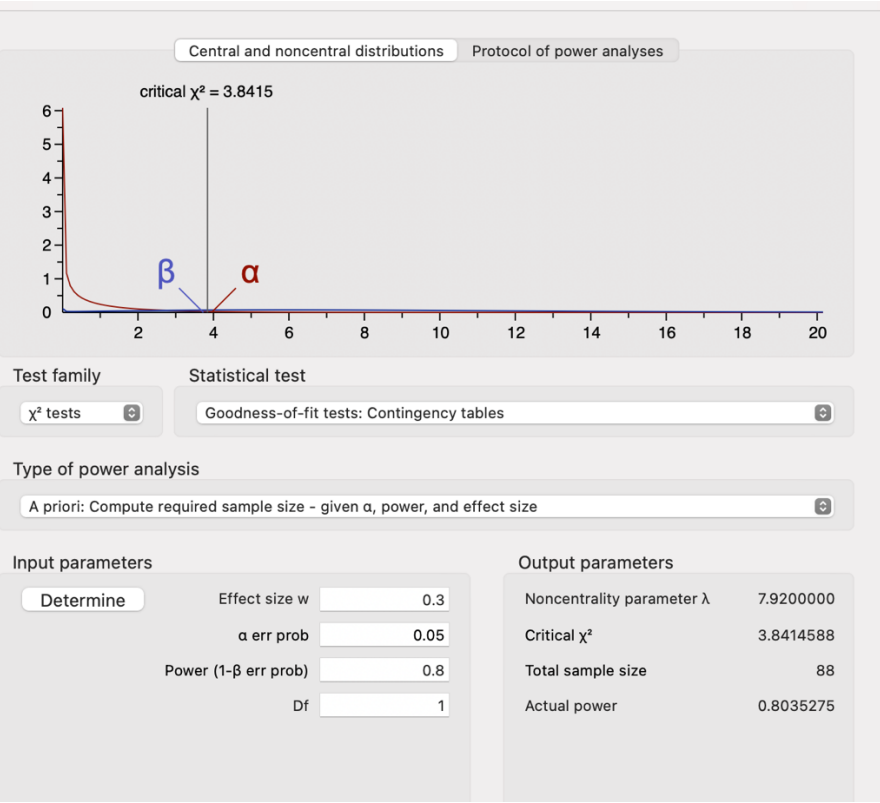
*RQ1 G*Power Analysis*



I also conducted an a priori power analysis for RQ2 to examine the appropriate sample size using G*Power3.1.9.6 (Kyonka, 2019) to test the goodness of fit with a medium effect size (*d* =.50) and an alpha of .05. Results showed that a total sample size of 88 participants was required to achieve a power of .80. Figure 2 depicts the G*Power analysis for RQ2.

Figure 2

*RQ2 G*Power Analysis*



RQ1: LOS Results

I conducted an independent sample *t* test using SPSS Version 27 to determine whether there is a statistically significant difference in LOS between EDs that utilize immediate bedding versus EDs that do not use immediate bedding. Table 2 represents the descriptive statistical data output for RQ1 using the total number of cases ($N = 18{,}022$). Table 3 displays the group statistics for the dependent variable versus the independent variable.

Table 2

RQ1 Descriptive Statistics

	N statistic	%
Does your ED use immediate bedding?	19,347	93.15%
Length of visit in minutes	19,581	92.04%
Valid *N*	18,022	

Table 3

RQ1 Group Statistics

	Does your ED use immediate bedding?	*N*	*M*	*SD*	Std. Error Mean
Length of visit in minutes	Yes	13,652	203.68	247.006	2.114
	No	4,370	248.58	361.310	5.466

Table 4

RQ1 Independent Samples t *Test*

		t test for Equality of Mans					95% Confidence Interval of the Difference		Cohen's effect size
		t	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper	
Length of visit in minutes	Equal variances not assumed	-7.660	5,732.948	< .001	-44.892	5.860	-56.389	-33.404	279.052

Results of the independent samples *t*-test, as shown in Tables 4 and 5, indicated that the mean length of visit between hospitals who had implemented immediate bedding (M = 203.68, SD = 247.006, n = 13,652) and hospitals who had not implemented immediate bedding (M = 248.58, SD = 361.310, n = 4,370) was statistically significant at the .05 level of significance ($t(18{,}020) = -9.256$, df = 18,020, $p < .001$). The null hypothesis was rejected.

RQ2: LWBS Results

I analyzed and compared ED LWBS data concerning the immediate bedding process via SPSS Version 27. A chi-square test was conducted to assess the variances of the dependent variable of ED LWBS against the independent variable of immediate bedding. Table 6 represents the descriptive statistical data output for the RQ2 utilizing the total number of cases (N = 19,347). In contrast, Table 7 displays the frequency statistics for the dependent variable versus the independent variable.

Table 5

RQ2 Descriptive Statistics & Frequency Table

		N	%
Does your ED use immediate bedding?	Yes	14,683	75.9%
	No	4,664	24.1%
The patient left without being seen	Yes	279	1.3%
	No	20,782	98.7%

Table 6

RQ2 Crosstabulation

			Left without being seen		
			No	Yes	Total
Does your ED use immediate bedding?	Yes	Count	14,509	174	14,683
		% within Does your ED use immediate bedding?	98.8%	1.2%	100.0%
	No	Count	4,612	52	4,664
		% within Does your ED use immediate bedding?	98.9%	1.1%	100.0%

Table 7

RQ2 Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.151[a]	1	.698

a. 0 cells (.0%) have an expected count less than 5. The minimum expected count is 54.48.

As Table 5-7 show, the results of the chi-square analysis revealed a nonsignificant association between immediate bedding and ED LWBS [$x^2(1, N = 19{,}347) = 0.15, p = 0.70$]. Thus, I concluded there was no statistically significant association between immediate bedding and ED LWBS and, therefore, rejected the null hypothesis.

Summary

In Section 3, I presented the data collection and the results for the statistical analyses conducted to answer the following research questions: RQ1 –Is there a

relationship between the use of immediate bedding in the ED and the patients' LOS in U.S. hospitals between December 29, 2014 and December 27, 2015, and RQ2 - Is there a relationship between the EDs' use of immediate bedding and patients' incidences of LWBS in U.S. hospitals between December 29, 2014 and December 27, 2015 A *t* test was conducted for RQ1 and a chi-square was conducted for RQ2.

RQ1 analysis determined that the null hypothesis, $H_0$1: There is no statistically significant difference in patients' LOS between EDs that utilized immediate bedding versus EDs that did not utilize immediate bedding in U.S. hospitals between December 29, 2014 and December 27, 2015, is rejected due to the significance being less than .05. It is understood that the immediate bedding process has a positive relationship with ED LOS.

RQ2 analysis determined that the null hypothesis, H_{02}- There is no statistically significant relationship between the EDs' use of immediate bedding and patients' LWBS incidences in U.S. hospitals between December 29, 2014 and December 27, 2015, could not be rejected due to significance being greater than .05. These results showed no significant difference in the likelihood of a patient leaving without being seen between EDs who use immediate bedding compared to those EDs who do not use immediate bedding.

Section 4: Application to Professional Practice and Implications for Social Change

This study focused on examining the relationship between the immediate bedding process in EDs on ED LOS and ED LWBS. The goal was to understand if this process had a causal relationship with ED LOS and ED LWBS incidences. The retrospective, quantitative nature of the study allowed for statistical analysis of the secondary data using SPSS Version 27. This study's findings contribute to an increased understanding of patient flow within the ED on ED LOS and ED LWBS.

Interpretation of the Findings

The study results expand the knowledge of ED flow, ED LOS, and ED LWBS incidences. Patient flow, especially in a busy ED, is an intricate process, and the mismanagement of this flow leads to an increased ED patient LOS and ED LWBS incidences, which have the potential to lead to an increased number of adverse events and mortality rates (Salway et al., 2017).

RQ1: ED LOS

The average LOS for EDs without immediate bedding was 249 minutes, whereas the average LOS for EDs with immediate bedding was 204 minutes. The immediate bedding process is associated with a 45 minute or 18% decrease in ED LOS. These results support the alternate hypothesis that there is a statistically significant relationship between the ED's immediate bedding process and the patient's LOS.

These results align with previous similar studies, including Wallingford et al. (2018), who showed a 114 minute or 30% decrease in ED LOS after the patient flow process was implemented, and Sayah et al. (2014), who identified a 72minute or 30%

decrease in ED LOS after the patient flow process was implemented. However, Wallingford et al.'s study included structural modifications within the ED by introducing more vertical areas (i.e., chairs) for patients and decreased horizontal areas (i.e., stretchers). Wallingford et al. theorized that stretchers take up more space, and chairs allow for more patients to be seen and lead to a decrease in LOS.

RQ2: ED LWBS

The results of this study showed there was a nonsignificant association between ED LWBS and immediate bedding. There was almost no difference in LWBS incidences in EDs who implemented immediate bedding compared to EDs who did not use immediate bedding. The results showed that 1.2% of patients that LWBS in EDs who did use immediate bedding versus 1.1% of patients that LWBS in EDs who did not utilize immediate bedding. I assumed that if patients were bedded immediately with this new process, fewer patients would LWBS; however, the study did not reflect this or demonstrate a significant change.

These results are similar to a study by Ioannides et al. (2018) in which LWBS was higher post-intervention. Still, when they further compared this result to other variables, including the patient's acuity, they found LWBS lower. In contrast, Easter et al. (2019) showed a 0.66% to 2% decrease in LWBS after postimplementation of an immediate bedding method of split-flow.

Limitations of the Study

A significant limitation of this study was the use of different terminology that all have the same definition. Rui and Kang's (2015) survey identified the process as

immediate bedding. Still, through research, I have found that different states in the United States have coined the process using additional terms, including split-flow and DTR, though others could exist. The varying terms used to identify the same process skewed the research and literature review process.

While performing a literature review and research, a problem arose from the inability to use the 2016 and 2017 data sets due to the inaccuracy of the LOS variable. The CDC identified internal processing issues that calculated the LOS variable; however, they had not edited the 2016 and 2017 data by the time I completed this study (S. Schappert, personal communication, January 15, 2021). I contacted the CDC in August 2020 and January 2021 to ascertain if newer data would be made available; however, it has still not been modified. The 2018 data had recently been revised and published, but the summary table that provides insights into the sampling frame, study design, and hospitals included had not been released by the time this study was completed (S. Schappert, personal communication, January 15, 2021). The use of newer data would benefit the study results because the health care field is continually changing, including implementing standard electronic health records and modification of hospital requirements by the Joint Commission.

An additional limitation was the use of the NHAMCS secondary data provided by the CDC. The selection of participants and quality control could not be validated for this archival data; therefore, data accuracy and reliability could not be verified. Along with this, the available data provided by the CDC are based upon voluntary survey responses

from hospitals. These results have the possibility of being skewed based upon the number of survey responses received.

Recommendations

In this study, I aimed to identify a relationship between the immediate bedding process with ED LOS and ED LWBS. This study's results and limitations can help hospital leaders address the process of ED patient flow while simultaneously enacting positive changes. Hospital leaders should take these recommendations into account before beginning an implementation process in their ED.

One recommendation is to reproduce this study but make specific structural and area changes within the ED to maximize the effectiveness of the process. To utilize all possible available spaces in the ED, hospital leaders must ensure adequate stretchers and chairs for patients to sit. As Wallingford et al. (2018) explained, the use of the split-flow model of immediate bedding showed a 30% decrease in LOS. Split-flow is an immediate bedding process by which patients who can sit in chairs do so, and those who require stretchers are given such (Wallingford et al., 2018). The removal of some horizontal stretchers allows for multiple chairs to be placed, thereby increasing the number of patients seen by the physician team.

Another recommendation would be to replicate this study within similar hospital types, such as all academic institutions. In this study, I utilized data made available from the CDC; however, this data included all EDs in the United States, including community hospitals, academic hospitals, and hospitals in rural and suburban areas. This vast range of hospital types can affect and skew the results.

Furthermore, another recommendation when replicating this study would be to include additional variables. Additional variables could allow the researcher to understand better the internal factors affecting ED flow, such as radiology, laboratory, and transport. These additional factors could provide better insight into throughput issues within the ED and facility as a whole. If included some of these factors can affect LOS and LWBS, thereby changing the results.

Implications for Professional Practice and Social Change

Professional Practice

EDs are a critical area within the hospital and play a crucial role in the community's well-being. This study helps hospital leaders understand the necessity of improving and maintaining efficient ED flow using the immediate bedding process. The results of this study may guide other health care systems in understanding how systems affect outcomes, thereby modifying their current ED flow system into a more efficient one, such as by implementing immediate bedding or split-flow. When systems flow more efficiently, the overall department and hospital benefit in the long run because all hospital areas are connected in one way or another.

Positive Social Change

Implications for positive social change include the potential to improve both the efficiency and utilization of resources with the ED. Unfortunately, many U.S. citizens in lower socioeconomic areas frequent EDs instead of primary care physicians (Kangovi et al., 2013). Due to this, EDs are experiencing overcrowding and are already considered one of the hospital's most challenging departments (Yarmohammadian et al., 2017). If

hospital leadership understands the barriers that hinder the health of the population, whether socioeconomic or systemic, they can increase patients' ability to receive efficient and quick care. Addressing these barriers, including patient flow within the ED, can improve patient outcomes and ensure care is delivered more efficiently. The reduction of LOS and LWBS ensures patients receive the appropriate level of care within a reasonable timeframe.

The improvement of ED flow also can improve efficiency and throughput in the hospital. More efficient patient flow also has the potential to improve patient treatment, patient satisfaction scores, and patient mortality. Though these are possible positive outcomes, they would require further research to determine the exact relationship and correlation.

Conclusion

This study focused on examining the relationship between EDs that utilize the immediate bedding process and those who do not. The variables analyzed were LOS and LWBS using data from the CDC's 2015 NHAMCS. The results demonstrated a positive relationship between immediate bedding and ED LOS, with an 18% reduction in LOS in EDs that utilized the immediate bedding process. On the contrary, the results showed a nonsignificant association between immediate bedding and ED LWBS. This study confirms that improving patient flow within the ED by implementing an efficient process can effect positive change by decreasing a patient's LOS. Though these results were positive, further research and knowledge on the immediate bedding process would be advantageous to the health care field. There are confounding variables that could affect

the results, including, but not limited to, the patient's chief complaint, a patient's comorbidities, and overall hospital volume.

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