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Hospital Characteristics Impact on Left Without Being Seen

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HOSPITAL CHARACTERISTICS IMPACT ON LEFT WITHOUT BEING SEEN

Medical University of South Carolina

Doctoral Project

By

Anthony Roberts

A doctoral project submitted to the faculty of the Medical University of South Carolina
in partial fulfillment of the requirements for the degree
Doctor of Health Administration
in the College of Health Professions

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Abstract of Dissertation Presented to the

Medical University of South Carolina

In Partial Fulfillment of the Requirements for the

Degree of Doctor of Health Administration

HOSPITAL CHARACTERISTICS IMPACT ON LEFT WITHOUT BEING SEEN: A CORRELATIONAL ANALYSIS BASED ON 2019 TIMELY AND EFFECTIVE CARE MEDICARE DATA

By

Anthony Roberts

Chairperson: Dr. Jamie Jones

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Abstract

Emergency Department (ED) care is provided to patients for urgent and life-threatening emergencies. Inefficiency and overcrowding of ED continues to be a problem for the U.S. Health systems threaten the ability to provide care for the most vulnerable patients. The inefficiency of ED and hospital throughput creates challenges in being able to provide timely and effective care for ED patients. Prolonged ED wait times can be related to the availability of ED and hospital beds, inefficiencies in the emergency department, staffing, and other factors. Timely and effective care is important to providing high-quality care and decreases the risk of serious injury or illness. When a patient leaves without being seen (LWBS), the ED physician does not have an opportunity to provide a medical screening exam to evaluate the patient's condition and assess the reason for seeking emergency care. Limited research has been conducted to understand if there is a positive relationship between hospital characteristics and LWBS rates in CMS patients using national-level data. The goal of the current project is to examine the potential impact of hospital characteristics on ED efficiency as measured by LWBS rates using currently available Medicare data from the data source of Timely and Effective Care National from emergency department visits. The limited dataset from the survey period of 2019 and 2022 was used to extract all records for Medicare beneficiaries.

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Chapter I Introduction

1.1 Background

Emergency Department (ED) care is provided to patients for urgent and life-threatening emergencies. Approximately 1.7% of patients who visit the ED left without being seen (LWBS) in United States hospitals (Moe & Belsky, 2016). A medical screening exam (MSE) includes diagnosis, stabilization, and treatment of any emergency conditions (Roby et al., 2022). An emergency medical condition is when a patient visits an ED with acute symptoms that if the patient does not receive medical care could seriously impact the patient's health (Austin, 2011). A LWBS patient is someone who does not receive a medical screening exam or complete emergency care and has the unknown risk of being undiagnosed and untreated which could lead to a serious adverse outcome (Roby et al., 2022).

The Emergency Medical Treatment and Labor Act (EMTALA), a law enacted in 1986, requires hospitals to provide a medical screening exam (MSE) by a qualified medical provider to any patient who believes they have an emergency medical issue (Austin, 2011). To be held accountable to the requirements of EMTALA, a hospital must have the capability and capacity to care for the patient regardless of the patient's ability to pay (Austin, 2011). Capability means that the hospital can provide the necessary resources for the patient's treatment needs such as medical specialists (Austin, 2011). Capacity means that the hospital has the necessary resources to care for the patient when they need them such as available staff and beds (Austin, 2011). EMTALA was also intended to prohibit the transfer of unstable patients to another facility unless the patient would receive a higher level of care to prevent the unnecessary transfer of medically unstable patients (Austin, 2011). If the hospital does not have the capability or capacity to care for the patient, they can deny a transfer from a sending facility. If the patient is already in the ED and the hospital does not have the capability or capacity to care for the patient, the hospital may transfer the patient to a hospital that can provide a higher level of care (Austin, 2011).

Contradictions in the literature exist related to significant outcome variations in patient's health outcomes or access to future healthcare in patients with LWBS (Roby et al., 2022). Some authors have argued that LWBS patients generally have low acuity complaints and may have resolved their issues without the need for additional care (Li, Brennan, Kreshak, Castillo, & Vilke, 2019). Although hospitals track LWBS rates, little is documented about the patient's condition after they leave the ED (Roby et al., 2022). Significant variation exists between patient wait times in EDs across the country and can be impacted by the volume of patients seen, efficiency, ED staffing, admission process, or availability of inpatient beds (Allen, Gian, & Simon, 2022).

ED efficiency can be measured by patient wait times, ED admitted length of stay, and discharged length of stay, as well as other metrics (Allen, Gian, & Simon, 2022). Hospital systems utilize the Left Prior to Medical Screening Exams (LPMSE), left before medical treatment (LPMT), Left Without Being Seen (LWBS), and Left Before Treatment is Complete (LBTC) to measure the efficiency of emergency departments (Li, Brennan, Kreshak, Castillo, & Vilke, 2019). When a patient leaves the emergency department before the physician has an opportunity to evaluate the patient's condition, the patient's outcome is often not clear. Several factors may impact a patient's decision to leave against medical advice (AMA) or LWBS, including unhappiness with care, limited improvement with treatment, mental health, lack of insurance, limited advanced medical care, lack of coordination of care, and length of stay (Albayati et al., 2021). Patients that leave before their treatment is completed are at risk for adverse outcomes which also creates a missed revenue opportunity for the hospital. When a patient leaves against medical advice, they leave before the doctor recommends the patient leave (Albayati et al., 2021). The difference between LWBS patients and AMA patients is that LWBS patients have not had a medical screening exam by a physician. AMA patients and LWBS are considered high risk by the American College of Emergency Physicians for adverse outcomes (Patients who leave AMA: Understand your risks and responsibilities 2009). Increased LWBS rates can lead to readmission rates or an increase in return visits to the emergency room for care (Smalley et al., 2021). Patients that left before treatment was completed in the Smalley (2021) study, (41.7%) returned to the ED within 24 hours and the majority

(76%) returned within 10 days. In another study, 49.1% of patients went to a clinic or a different ED within 24 hours (Brar et al., 2018).

The goal of this paper is to examine the relationship between hospital characteristics and ED efficiency, as measured by LWBS rates. Emergency department visits from 2019 and 2022 from the Timely and Effective Care National data registry will be used to examine the relationship in this paper between hospital characteristics and LWBS rates. The primary objective is to determine if there is a statistically significant association between the independent variable of hospital ownership and the dependent variable LWBS. The secondary objective is to determine if there is a statistically significant association between the independent variable of EDV and LWBS and to determine if there is a positive relationship between the independent variables of overall quality score and LWBS. It is unclear how hospital characteristics may be correlated to LWBS rates.

The research is aimed to inform others of the impact of hospital characteristics on prolonged ED wait times and LWBS rates. The findings of the study could help consumers determine the right hospital to seek care in based on hospital characteristics, prolonged emergency room wait times, and LWBS rates. The study may also assist hospital administrators in understanding the impact of hospital characteristics on LWBS rates and allow them to develop strategies to minimize the number of patients that LWBS due to hospital inefficiencies and wait times. There is a need to continue research to understand the relationships between patients and LWBS and hospital characteristics.

Chapter 2

Search strategy for the literature review

To identify relevant literature on this topic, databases for search words related to the emergency department were examined. The databases utilized were CINAHL, PUBMED, SCOPUS, Healthcare Administration, and other accessible databases within MUSC libraries. Various search terms were used including *ED, ER, Emergency Room, Emergency Rooms, Emergency Services, Emergency Wards,*

Emergency Department, ED Overcrowding, Overcrowding, Wait Times, Waiting Times, Left Without Being Seen, LWBS, leaving without being seen, hospital characteristics, emergency department visits, and ED efficiency. Due to the large amount of literature published in the last 30 years on ED Wait times, ED Overcrowding, and LWBS, only English language studies published were used. References greater than 10 years old were considered for the literature search related to ED overcrowding and ED throughput being well established in that timeframe. The majority of the studies included were filtered to the last 10 years. Peer review studies specifically focused on ED Wait times and LWBS rates were included for a more in-depth review of the study design, findings, and limitations. A total of 1,121,698 articles were available from the search of the literature utilizing all of the above search terms. When limiting to the last 10 years, we utilized PubMed and the Healthcare Administration database which decreased the number of total articles to 108 in PubMed and 110 in the Healthcare Administration Database. There were 71 peer-reviewed articles found related to ER, Emergency department, wait times, and ER overcrowding. Two primary studies were used in the scoping review that defined patient characteristics that have a positive relationship to LWBS. Three primary studies were referenced related to hospital characteristics and the relationship to LWBS.

2.1 Literature Review

Inefficiency and overcrowding of ED continue to be a problem for U.S. hospitals, and overcrowding threatens their ability to care for the most vulnerable patients. In an Australian study, similar to studies completed in the U.S., there is a documented positive relationship between overcrowding of the ED and LWBS (Claret et. Al, 2016). As ED wait times increase, patients are more likely to LWBS which has been demonstrated to increase risks for unintended adverse events (Allen, Gian, & Simon, 2022). The efficiency of the ED and hospital throughput creates challenges in being able to care for ED patients. Prolonged ED wait times are related to the availability of ED and hospital beds, efficiencies of ED, and staffing. Timely and effective treatment is important in receiving high-quality care and decreases the risk of serious injury or illness (Tsai, Sharieff, Kanegaye, Carlson, & Harley,

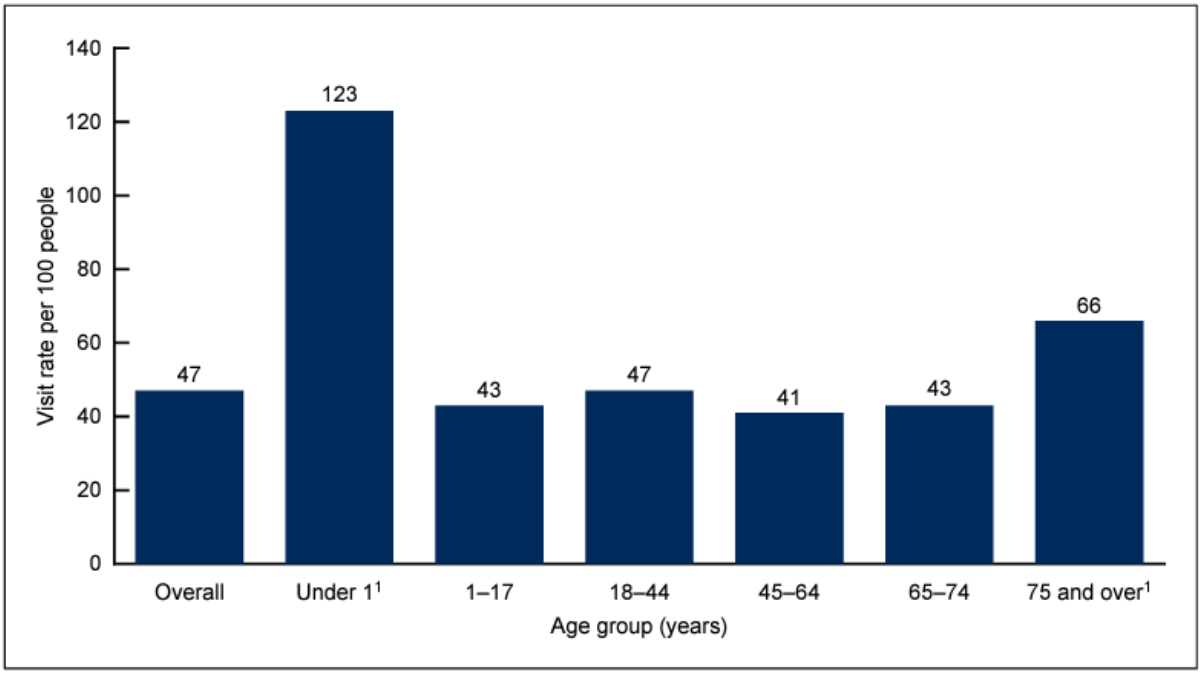
2012). One of the most critical issues is a hospital's capability and capacity to provide emergency care to patients in the community. It is common for hospitals to close patient admission to hospital beds or go on various levels of care or ED diversion due to decreased capability or capacity (Claret et al., 2016). Cases have been reported in the literature of patients developing complications and even dying while waiting for care in the emergency department (Pham, Ho, Hill, McCarthy, & Pronovost, 2009). Three categories may cause overcrowding in the emergency room including the increased number of patients that seek emergency room care, ED throughput, and the increased demand for inpatient beds which impacts the boarding of patients in the ED (Allen, Gian, & Simon, 2022).

There is research linking the relationship between patients with prolonged wait times in the ED with higher LWBS rates. Rates are reported in the Timely and Effective data from CMS with a national average of around 2% and as high as 15% (Smalley et al., 2021). Some studies have conducted process improvements to improve efficiency in an attempt to impact LWBS. However, little improvement in meeting the National goal of less than 1% LWBS has been realized in the U.S. Numerous articles focus on the loss of admission and the potential financial impact. The financial impact of the loss of admission is recognized as a significant issue. In one study, the loss of revenue per patient was over $13,000; however, financial impact will not be the focus of this study (Pines, Jesse M., MD, M.B.A., M.S.C.E., Batt, Hilton, & Terwiesch, 2010). Most of the studies available related to LWBS were noted to be primarily more regional. The majority of the studies in the literature review were retrospective and quantitative. The focus of the literature review will be the background of ED utilization demographics, availability of beds, characteristics of patients that LWBS, ESI level impact on LWBS rates, and hospital characteristics. The Emergency Severity Index (ESI) is used by ED nurses to triage the acuity of patients (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014).

Several factors impact a patient's decision to leave AMA or LWBS, including unhappiness with care, limited improvement with treatment, mental health, lack of insurance, limited advanced medical care, lack of coordination of care, and length of stay (Albayati et al., 2021). There is a significant impact of a one-hour reduction in holding patients in the emergency department and would generate an additional

$9693 to $13,298 from left without being seen and ED Diversion (Pines, Jesse M., MD, M.B.A.,

Figure 2. Emergency department visit rates, by age group: United States, 2019



[1]Significantly different from all other age groups.
NOTES: Based on a sample of 19,481 emergency department (ED) visits made by patients in 2019, representing an annual average of approximately 151 million ED visits. Visit rates are based on the July 1, 2019, set of estimates of the U.S. civilian noninstitutionalized population as developed by the U.S. Census Bureau's Population Division. Access data table for Figure 2 at: https://www.cdc.gov/nchs/data/databriefs/db434-tables.pdf#2.
SOURCE: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, 2019.

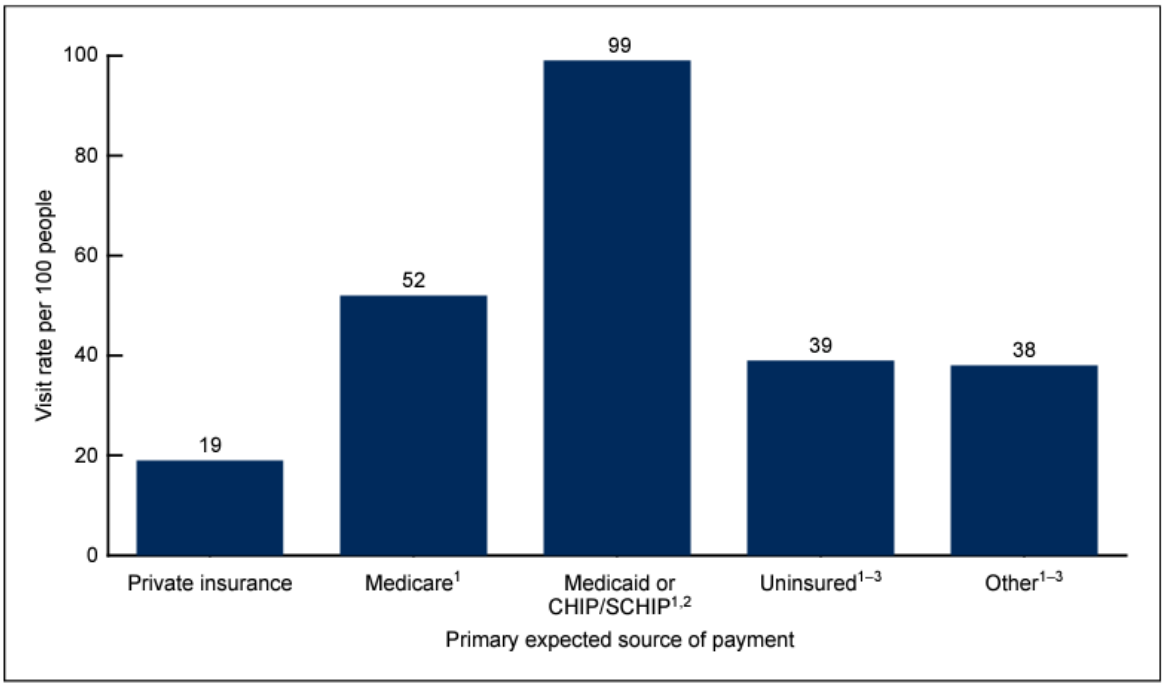
M.S.C.E., Batt, Hilton, & Terwiesch, 2010). Although there is data on the revenue per admission, and modeling for a loss related to a patient LWBS, there is not a significant amount of literature on the subject. The potential impact of LWBS on hospital finances can be significant

ED utilization

According to data from the National Hospital Ambulatory Care Survey in 2019, there were an estimated 151 Million emergency department visits in the United States. A potential change that has impacted the ED in recent years is a loss of hospitals in the U.S. From 1993 to 2003, the United States lost 435 hospitals, which is a 9% decrease (Reese, 2008). Medicaid expansion as a result of the Affordable Care Act (ACA) had a goal to increase patient access to primary care at lower-cost healthcare sites, which could decrease ED utilization and overcrowding (Allen, Gian, & Simon, 2022). In the study conducted by Allen, Gian, and Simon (2022), although some states showed lower ED volume, other Medicaid expansion states had higher utilization of the ED. Among the highest utilization of ED visits

per payer type, Medicaid or Children's Health insurance program had the highest with approximately 99 visits per 100 people (National Vital Statistics Reports (online), 2019). The ED visit rate for adults 75 years and older has the highest rate, except for infants less than 1 year (National Vital Statistics Reports (online), 2019). The payer class group with the lowest utilization of ED visits is private insurance with 19 visits per 100 people (National Vital Statistics Reports (online), 2019). During this same time, the population increased by 2%, and due to an aging population, admissions grew 13% with an increase in ED visits by 26% (Reese, 2008). Overall, ED visit rates have remained relatively consistent from 2009 to 2019 between 45-47 visits per 100 people (National Vital Statistics Reports (online), 2019). ED visit rates differ between females at 50 visits per 100 females compared to 43 visits per 100 males in 2019 (National Vital Statistics Reports (online), 2019). The ED visit rate for non-Hispanic black people in 2019 was 87 visits per 100 people which is higher than all other racial and ethnic groups (National Vital Statistics Reports (online), 2019). Medicare patients utilized the emergency department at approximately 52 per 100 people which is more than uninsured rates as well as other payer sources referenced (National Vital Statistics Reports (online), 2019).

Figure 4. Emergency department visit rates, by primary expected source of payment: United States, 2019



[1]Significantly different from Private insurance.
[2]Significantly different from Medicare.
[3]Significantly different from Medicaid or CHIP/SCHIP.
NOTES: CHIP/SCHIP is Children's Health Insurance Program/State Children's Health Insurance Program. Based on a sample of 19,481 emergency department (ED) visits made by patients in 2019, representing an annual average of approximately 151 million ED visits. Figure excludes 13.5% (weighted) of visits for which data were missing or blank. Visit rates are based on patient's primary expected source of payment and proportional insurance data from the 2019 National Health Interview Survey, calculated from: https://www.cdc.gov/nchs/nhis/2019nhis.htm. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db434-tables.pdf#4.
SOURCE: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, 2019.

According to the July 2021 Healthcare Spending and the Medicare Program from the Medicare Payment Advisory Commission, approximately $76B is spent on outpatient services which includes ED services (Data book, healthcare spending and the Medicare program.). Over 90% of hospitals offer Emergency Services to patients, which has declined by a few percentage points over the last 10 years (National Vital Statistics Reports (online), 2019).

Recent changes in Medicaid expansion may or may not have an impact on emergency room utilization in the United States. In a study evaluating the impact of Medicaid expansion on the use of emergency rooms, the authors found a relative increase of 10% in time to see a provider, an increase in wait time by 3.8 minutes, and the percentage of patients that LWBS increased by .3 percentage points (Allen, Gian, & Simon, 2022). Further research needs to be conducted to understand the impact of LWBS on payers, including government payers, as one of the goals of the Medicaid expansion is to

provide increased access to care in other non-emergency locations to decrease utilization of emergency room services.

One study found that a small percentage of approximately 2.7% of patients are high utilizers and accounted for approximately 67% of emergency department visits during a 1-year period (Krieg, Hudon, Chouinard, & Dufour, 2016). These patients are likely to require more frequent care related to multiple chronic conditions, substance abuse, or some form of mental illness (Krieg, Hudon, Chouinard, & Dufour, 2016). High utilizers of emergency care could benefit from the use of preventative or primary care which could reduce the use of emergency care (Krieg, Hudon, Chouinard, & Dufour, 2016).

Availability of beds

Holding patients in the emergency department due to a lack of inpatient beds is one of the most common causes of ED overcrowding (Pines, Jesse M., MD, M.B.A., M.S.C.E., Batt, Hilton, & Terwiesch, 2010). Boarding of patients in the ED has been associated with a hospital capacity exceeding 85-90% utilization of available beds (Janke, Melnick, & Venkatesh, 2022). ED patients are competing for the same beds as planned admissions such as surgeries and direct admissions, often without clear prioritization of bed assignments. There is additional competition for inpatient beds that occurs from transfers needed for changes in the level of care. Admissions through the ED are often the last priority causing a backup in the emergency department (Claret et al., 2016). Surgical patients and planned admissions were more likely to obtain a bed than emergency room patients who are often considered to be medical patients that are older with multiple comorbidities (Claret et al., 2016).

Lack of staff in the inpatient units is a common issue that has been amplified with the onset of COVID-19. Hospitals frequently have available beds in the hospital but do not have the beds available to patients due to staffing shortages. According to a study from the Government Accountability Office (GAO), twenty percent of admitted patients are held in the ED for over 8 hours, and ninety percent of

hospitals hold inpatients in the ED for over 2 hours (Reese, 2008). Nursing shortages continue to inhibit hospitals from opening additional inpatient beds leading to ED overcrowding. Labor costs have increased dramatically since COVID-19 with total expense per adjusted discharge increasing by more than 10% for hospitals (Early, 2022). Availability of full-time equivalents has decreased by more than 5% from 2020 to 2021 (Early, 2022).

Characteristics of patients that LWBS

There is general concern about patients who do not complete their care process in the emergency room. The metric LWBS is collected by CMS, and hospitals utilize this metric to better understand their performance related to opportunities for improvement. LWBS can be defined as a patient encounter with documentation from a triage nurse who left the hospital before a medical screening exam from a provider (Li, Brennan, Kreshak, Castillo, & Vilke, 2019). It has been established in the literature that patients who have LWBS typically have lower acuity, don't arrive by ambulance, and are younger (Moe & Belsky, 2016). Lower acuity patients who have LWBS may decrease the concern of the risk of adverse outcomes, however, 8% of LWBS patients are triaged in the highest acuity (Pham et al., 2009). Minorities who do not have private insurance were also found to have higher rates of LWBS (Pham et al., 2009). Patients without insurance have the highest LWBS rates at approximately 26% (Pham et al., 2009). Hsia et al. (2011) study in California on hospital determinants of LWBS reported that low-income patients, poorly insured, had a disproportionately higher rate of LWBS.

In the study conducted by Moe and Belsky (2016) utilizing data from the 2009-2011 National Hospital Ambulatory Medical Care Survey (NHAMCS) a retrospective cross-sectional analysis to compare hospital, patient, and visits that left before completion of medical care demonstrated increasing LWBS rates (Moe & Belsky, 2016). Overcrowding of emergency departments with higher ED volumes has been shown to have higher rates of LWBS (Moe & Belsky, 2016). The Moe and Belsky study (2016) utilized a national dataset and focused on LWBS versus after the medical screening exam was completed but left before the completion of care (Moe & Belsky, 2016).

Although there is more than one study that analyzes LWBS characteristics there are some variations in results. This could be related to the data sets utilized, the study designs, sample sizes, and various populations based on the regions, states, or countries (Sheraton et al., 2020).

As organizations strive to understand patient, process, and organizational characteristics, it is reasonable to explore opportunities to predict LWBS patients. Understanding institutional characteristics could assist caregivers in predicting LWBS is important to designing process, service, and clinical delivery models. Pham et al. (2016) conducted by utilizing the NHAMCS to estimate the national LWBS rate and to identify visit, patient, and institutional characteristics that could assist in predicting LWBS in the United States (Pham, Ho, Hill, McCarthy, & Pronovost, 2009). In the retrospective cross-sectional analysis, patients with low acuity, academic institutions, non-white, Medicaid, or self-pay were more likely to LWBS (Pham, Ho, Hill, McCarthy, & Pronovost, 2009). The authors suggested that these patients are most at risk due to not having access to primary care and are at higher risk for adverse events (Pham, Ho, Hill, McCarthy, & Pronovost, 2009). Pham et al. (2009) also found that urban area hospitals, crowded ED rooms in urban areas, and teaching institutions had higher rates of LWBS. Pham et al. (2009) also found that patients who had any diagnostic or therapeutic intervention were less likely to LWBS which could assist hospitals in improving processes to decrease LWBS rates. McCaig et al. (2012) describe the strengths of utilizing the NHAMCS as a large, national survey with a strong methodology. Challenges with the NHAMCS dataset are that it is complex and difficult to interpret which could lead to inaccurate-conclusions (McCaig et al., 2012). Due to NHAMCS being visit-based instead of population-based, utilizing it for prevalence can create system bias (McCaig et al., 2012).

A study conducted by Tropea et. al. (2012) was selected due to the approach to predict factors that lead to AMA. However, the study was a regional study conducted in Australia and may not be generalizable to hospitals in the U.S. Earlier studies were limited to the characteristics or reasons for LWBS, and research has focused on delays in care and overcrowding and not as much on social characteristics that could impact LWBS rates (Tropea et al., 2012). The Australian study found that

LWBS patients were often younger males, with lower urgency conditions, and arrived without transport (Tropea et al., 2012). The researchers also found that larger hospitals with longer wait times had higher LWBS rates, and there was a lower risk of hospital admission without a demonstrated risk of an increase in mortality (Tropea et al., 2012). There was, however, a high risk of the patient returning to the emergency department to seek additional care (Tropea et al., 2012). The authors acknowledged limitations of the study were not having access to certain data such as hospital type, location, ED staffing, hospital capacity, or the reason for the patient's LWBS (Tropea et al., 2012). Similar to other retrospective analyses that utilize clinical documentation such as time stamps, the research can only be as accurate as the information documented and lacks other clinical information such as presenting diagnosis (Tropea et al., 2012).

In a study conducted in Canada, a questionnaire was sent to patients asking them why they had LWBS. It was found that 49.1% chose an alternative healthcare location within 24 hours, and lack of communication-related to wait times and long wait times were the most common reasons cited (Roby et al., 2022). Additional qualitative and quantitative studies need to be completed to understand the risks and reasons for patients that LWBS.

ESI level impact on LWBS rates

Although there have been studies on the impact of wait times on LWBS, there is limited data on the ideal wait times and the potential impact on LWBS rates (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014). Lucas (2014) utilized the Emergency Severity Index (ESI) which is used by emergency room nurses to triage the acuity of patients to determine the approximate wait time by ESI levels to determine a LWBS target rate of less than 2% (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014). ESI level I requires immediate life-saving intervention, ESI level II demonstrates a high-risk situation such as confusion, lethargy, or severe pain or distress, ESI levels III, IV, and V are determined not only by the acuity but also the level of resources required to disposition the patient (Edwards, 2013). ESI level III requires two or more resources, ESI level IV requires at least one resource, and Level V requires no resources (Edwards, 2013). A resource needed

can be defined as a lab test, an x-ray, ultrasound, IV fluids, pain relief, CT scans, or other interventions. Lucas determined that LWBS rates were the highest driving factor for ESI level III (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014). To achieve an overall LWBS target of less than 2% the wait time for ESI III should be 45 minutes and IV, and V should be less than 60 minutes (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014). The evidence demonstrated that patients with higher ESI levels are less sensitive to wait times than lower acuity patients with higher ESI levels. This suggested that the focus for improvement efforts for wait times should be primarily concentrated on lower acuity patients with ESI levels of 4 and 5 (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014). The study listed limitations that the wait time target methodology should apply to other hospitals, but other factors could impact abandonment that were not the focus of the study (Lucas, Batt, & Soremekun, Olanrewaju A., M.D., M.B.A., 2014).

Hospital Characteristics

Hospital ownership can be defined as for-profit, not-for-profit, or government. The government consists of local, state, and hospital districts or authorities. Hospital type consists of acute care hospitals, critical access hospitals, children's, and psychiatric. ED volume is also a hospital characteristic that is included in the dataset. ED volume is classified as very high (>60k visits), high (40k-59,999 visits), medium (20,000-39,999 visits), and low (<19,999 visits) (CMS Outpatient Public Reporting Preview Guide, 2021). According to the American Hospital Association, there are approximately 6100 hospitals in the U.S. There are approximately 4700 Medicare-qualified facilities in the U.S. that submit data to the Timely and Effective Care Survey.

Total Number of All U.S. Hospitals	6,129
Number of U.S. **Community**[1] Hospitals	5,157
Number of Nongovernment Not-for-Profit Community Hospitals	2,978
Number of Investor-Owned (For-Profit) Community Hospitals	1,235
Number of State and Local Government Community Hospitals	944
Number of Federal Government Hospitals	206
Number of Nonfederal Psychiatric Hospitals	659
Other[2] Hospitals	107

Source: https://www.aha.org/statistics/fast-facts-us-hospitals Date: 9/7/2023

CMS and other entities also track quality scores by utilizing overall star ratings. The overall star ratings evaluate a hospital's overall performance based on performance groups weighted by percentage of mortality (22%), safety of care (22%), readmission (22%), patient experience (22%), and timely and effective care (12%)) (CMS Outpatient Public Reporting Preview Guide, 2021). In the timely and effective care database, the overall quality rating is scored in an overall rating from 1 to 5 with 5 being the highest possible score. The overall quality score allows for a single aggregate score to compare a hospital's quality performance.

The table below shows the distribution of U.S. hospitals Overall Star Rating based on July 2023 results.

Overall rating	Number of hospitals (N=4,654, %)
1 star	250 (5.4%)
2 stars	668 (14.4%)
3 stars	872 (18.7%)
4 stars	803 (17.3%)
5 stars	483 (10.4%)
N/A	1578 (34.0%)

Source: https://data.cms.gov/provider-data/topics/hospitals/overall-hospital-quality-star-rating/ Date: 9/7/2023

Hsia et al. (2011) utilized the National Hospital Ambulatory Medical Care Survey (NHAMCS) to conduct a retrospective cross-sectional study of acute-care, nonfederal hospitals in California on hospital determinants of LWBS rates. NHAMCS is a survey conducted by the CDC and Prevention Division of Health Care Statistics (Pham et al., 2009). The primary outcomes of the study reported an increased likelihood of LWBS rates with low-income, poorly insured, county ownership, teaching hospitals, and trauma designations (Hsia et al., 2011). Pham et al. (2009) also utilized NHAMCS to conduct a retrospective cross-sectional analysis to estimate the LWBS rate and to identify patient, visit, and institutional characteristics that predict LWBS rates. The results of the Predicting LWBS study demonstrated that hospitals that have more patients without insurance have higher rates of LWBS (Pham et al., 2009).

Sheraton et al. (2020) conducted a retrospective cohort analysis utilizing the Nationwide Emergency Department Sample Database (NEDS) which is part of the Healthcare Cost and Utilization Project to develop a prediction model to identify factors that have an increase in LWBS rates. NEDS is one of the largest ED databases in the U.S. and is a partnership through Federal, State, and Industry and is sponsored by the Agency for Healthcare Research and Quality (Sheraton et al. 2020). The patient demographics with higher LWBS rates were males aged 36 to 64, low-income, and very high volume EDs, and urban area hospitals were statistically significant (Sheraton et al. 2020).

Summary

The literature search provided insight and information related to the causes of overcrowding and potential interventions related to inefficiencies in the emergency department. The patient demographics that are attributed to patients with LWBS are well documented in the literature. Minorities, low income, no primary insurance, males, median age 36-64 years old, and low acuity patients are the most likely to LWBS (Sheraton et al., 2020). Increased wait times were also correlated with higher LWBS rates. Patients who visited on weekends and those with chronic illnesses had lower LWBS rates(Sheraton et al., 2020).

Further research is needed to understand the impact of delays in ED care on patient outcomes. Improving efficiency in the emergency department is critical because many resources are needed to manage care processes and decrease wait times. It is a reasonable assumption that delays in care impact satisfaction, outcomes, and reimbursement, without fully understanding the unintended consequences or the actual impact on LWBS patients. In the literature search that was conducted, very few studies have examined the relationship between hospital characteristics and LWBS rates utilizing the CMS dataset. This study will fill a gap in the literature by examining hospital characteristics associated with LWBS rates in the EDs, using CMS data on a national level.

Chapter III Methodology

3 Methods

3.1 Research Questions:

The purpose of this study is to understand the relationships between LWBS rates and multiple hospital characteristics. This paper will address the following research questions.

1. Research Question 1: Is there a statistically significant association between hospital ownership (Proprietary, Not-Profit, and Government) and LWBS?
2. Null Hypothesis: There is no statistically significant difference between hospital ownership and LWBS.

   Alternative Hypothesis: There is a statistically significant association between hospital ownership and LWBS.
3. Research Question 2: Is there a statistically significant association between ED volume (EDV) and LWBS?

   Null Hypothesis: There is no statistically significant difference between EDV and LWBS.

   Alternative Hypothesis: There is a statistically significant association between EDV and LWBS.
4. Research Question 3: Is there a positive relationship between overall hospital quality score rating (QS) and LWBS?
5. Null Hypothesis: There is no relationship between different levels of QS 1,2,3,4,5 and LWBS.

   Alternative Hypothesis: There is a relationship between different levels of QS 1,2,3,4,5 and LWBS.

3. 2 Data Source:

The proposed research study is selected from the population of U.S. hospitals that receive Medicare patients in the EDs. The retrospective approach will allow for utilizing national data to examine relationships between hospital characteristics, ED visits, and LWBS. The data source is the Timely and Effective Care-National dataset from data.cms.gov, from the survey submitted for 2019 and 2022 which is available to the public to download. This data will allow a control from 2019 (pre-COVID) and 2022 (Post-COVID). The Timely and Effective care measures are the process of care measures to show how effectively hospitals provide care in certain conditions or locations in hospitals. The Timely and Effective Care data is from 4700 hospitals in the US in 2019 and 2022. This is approximately 77% of all hospitals in the country.

For the analysis, the national dataset will be focused on hospital-level data in the national dataset from ED care only. Hospital Care Compare consists of data from over 4000 Medicare Certified hospitals which includes Critical Access, Acute Care, Children's, Psychiatric, and Veterans Hospitals. The data is updated quarterly with select data such as EDV updated annually. The data set includes measures for cataract surgery, colonoscopy, heart attack, ED, preventative care, and pregnancy and delivery care. Psychiatric hospitals and tribal and pediatric specialty hospital observations were excluded from the study due to the uniqueness of the specialty hospitals' EDs. It is noted that although the specialty hospitals are excluded, some psychiatric, tribal, and pediatric patients have received care in an acute care hospital and critical access hospitals and therefore, may have some representation in the dataset. Hospitals listed as having no emergency services were also excluded from the dataset.

3.3 Study Design:

A retrospective cross-sectional multivariate analysis was conducted to understand the relationships between multiple hospital characteristics, EDV, Overall Quality Ratings and LWBS rates.

In the CMS Timely and Effective Care, there are quality measures that are collected as a result of ED Care. For this project, a narrower selection of the metrics available was selected that was more closely related to the study's purpose of understanding the relationship between hospital Ownership, ED volume, hospital overall quality rating, and LWBS rates. Hospital ownership was selected due to an interest in understanding if there is a statistically significant difference in the performance of hospitals based on ownership of Proprietary, Not-For-Profit, and Government to LWBS rates. EDV was selected to understand if the CMS dataset has a similar positive relationship between EDV and LWBS rates that is found in the literature. Overall Quality Rating was selected to see if there was a positive relationship of quality score to LWBS rate. CMS requires submission of the OP-22 LWBS metrics used to measure quality and we were interested in understanding performance on that quality metric in comparison to other Timely and Effective Care metrics to understand if there was a positive relationship. To test the relationships in the hypotheses, the following variables were included in the analyses with models conducted using an SPSS database.

Characteristics:	**Description:**	**Data type:**	**Variable type**
Hospital Type:	Acute Care	Categorical	Independent
	Critical Access	Categorical	Independent
	Government: Government Local, Government-hospital district, Government state	Categorical	Independent
Hospital Ownership:	Non-profit: Voluntary non-profit private, voluntary non-profit church, voluntary non-profit	Categorical	Independent
	Proprietary (for-profit)	Categorical	Independent
EDV	Low, Medium, High, Very High	Categorical	Independent
Overall Star Rating	1	Numeric	Independent
	2	Numeric	Independent
	3	Numeric	Independent
	4	Numeric	Independent
	5	Numeric	Independent
LWBS Rate	%	Numeric	Dependent

3.4 Data Analysis:

Utilizing an SPSS Printout

A retrospective multivariable regression analysis was used to examine hospital characteristics' association with LWBS. A multivariable analysis utilizing LWBS as the dependent variable, and EDV, hospital ownership, hospital type, and quality score as the categorical primary independent variables. Since EDV, hospital ownership, hospital type, and EDV are categorical variables, each was separated into a unique dummy variable of 0 or 1. To avoid perfect collinearity, the dummy variables for government hospitals, low-volume ED hospitals, and non-critical access hospitals were included in the model as a comparison. Quality score was treated as a numeric variable in the model and each numeric individual quality score variables of 1, 2, 3, 4, 5 was included in the regression with the dependent variable of LWBS. The sample size estimate is 4718 hospitals in 2019 and 4718 hospitals in 2022. SPSS software was used for the analysis.

Chapter IV Results

Table 1

Hospital characteristics of patients that LWBS among CMS qualifying hospitals.

Variable	n=4718 (%)
Left Without Being Seen (LWBS)	2921 (61.9)
Hospital Ownership	
Govt	986 (20.9)
Non-Profit	2790 (59.1)
Proprietary	730 (15.5)
Not classified	212 (4.5)
Hospital Type	
Acute Care DOD	35 (.7)
Acute Care	3185 (67.5)
Childrens	89 (1.9)
Critical Access	1353 (28.7)
Not classified	56 (1.2)
ED Volume (EDV)	
Low	1189 (25.2)
Medium	728 (15.4)
High	448 (9.5)
Very High	559 (11.8)
Not classified	1794 (38.0)
Hospital Overall Rating	
1	239 (5.1)
2	650 (13.8)
3	852 (18.0)
4	759 (16.1)
5	447 (9.5)
Not classified	1771 (37.5)

4.1 Findings

Table 1 displays the frequency of variables utilizing descriptive statistics comparing the Dependent variable of LWBS% to Hospital Ownership, Hospital Type, LWBS volume, and Hospital Overall Rating. A total of 4718 hospitals were identified within the dataset as OP-22 LWBS metric from 2022 with 2921 with LWBS data and 1797 hospitals had missing LWBS data or were not

classified. The dependent variable LWBS was relatively low (M=1.39%, SD=1.85%). Hospital ownership (N=4718) consisted of Government 986 (20.9%), Non-profit 2790 (63.9%), and Proprietary 730 (15.5%), and no data or unclassified 212 (4.5%). Hospital type (N=4718) consisted of Acute Care DOD 35 (.7%), Acute Care 3185 (67.5%), Childrens 89 (1.9%), Critical Access 1353 (28.7%), and not classified 56 (1.2%). EDV included Low 1189 (25.2%), Medium 728 (15.4%), High 448 (9.5%), Very High 559 (11.8%), and not classified 1794 (38.0%). Hospital overall rating included hospitals with an overall rating of 1-5. Hospital overall rating with a score of 1.) 239 (5.1%), 2.) 650 (13.8%), 3.) 852 (18.0%), 4.) 759 (16.1%), 5.) 1771 (37.5%), and not classified 1771 (37.5%).

Table 2

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1802.957	7	257.565	416.163	0.000
Residual	2915.043	4710	0.619		
Total	4718.000	4717			

Dependent variable: LWBS
Predictors: Non-profit, Proprietary, Medium, High, Very High, Critical Access, Hospital Overall Rating

As part of the regression model, we used an ANOVA test displayed in Table 2 to understand the results of multiple independent variables predictors of Non-Profit, Proprietary, Medium, High, Very High, Critical Access, and Hospital Overall rating to determine if they statistically different from the overall mean of the dependent variable LWBS in the regression. The Sum of Squares for the Regression is 1802.957, $F(7) = 416.163$, $p = .000$ demonstrates a high positive value and is more likely that the variation is associated with the independent variable. The $P = .000$ with 95% confidence is less than <05 which is statistically significant and the predictors had a significant impact on LWBS rates. Therefore, we reject the null hypothesis and believe that there is a statistically significant association between the predictors and LWBS. In the analysis where we note there is a statistical significance, we cannot for

sure say where that difference is. To determine the difference, further post hoc tests would need to be conducted.

Table 3

Multivariate Regression

	Beta	Est. of Std. Error	df	F	Sig.
Non-Profit	-0.039	0.200	1	3.844	0.05
Proprietary	-0.078	0.016	1	25.520	0.000
Medium	0.414	0.016	1	648.431	0.000
High	0.361	0.015	1	546.800	0.000
Very High	0.439	0.015	1	840.193	0.000
Critical Access	0.005	0.017	1	0.108	0.742
Hospital overall rating	-0.054	0.031	1	3.172	0.075

Dependent Variable: LWBS %

Utilizing the Bootstrap method displayed in Table 3 we utilized Government as the reference value in comparing to Non-profit and Proprietary. The categorical variable Proprietary, (p=.000) had a negative Beta coefficient representing a lower LWBS % in comparison to the Government reference value. The categorical variable of Proprietary had a significant difference in LWBS rates compared to the reference value of Government. Non-profits (p=.05) show a negative correlation coefficient, representing a lower LWBS % in comparison to Government.

Utilizing the Bootstrap Method displayed in Table 3, we compared the categorical variables of Medium, High, and Very High were coded into binary variables so that the reference value was Low for comparison. The categorical variable of Medium (p=.000) had a significant impact on LWBS rates. The

categorical value of High (p=.000) had a significant impact on LWBS rates. The categorical value of Very High (p=.000) had a significant impact on LWBS rates.

Utilizing the Bootstrap Method displayed in Table 3, the ordinal variables of Overall Hospital Rating were used to understand the potential impact on LWBS. The ordinal variable Overall Hospital Quality Rating (p=.075) demonstrates a negative value representing a lower LWBS %.

Table 4

Model Summary

Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
0.618	0.382	0.381	0.618

Dependent Variable: LWBS%
Non-Profit, Medium, High, Very High, Critical Access Hospital

Table 4 displays the dependent variable with predictors of Non-Profit, Medium, High, Very High, and Critical Access. The R-squared .382 is low because there are more independent variables added to the model. It is positive and measures the goodness of fit of the linear regression model. The adjusted R-squared .381 is explained variation and .619 is unexplained variation in the linear regression model which goes to the error term of the model. The Adjusted R-squared is adjusted for the number of predictors in the model. The R-squared .381 is the explained variation and .618 is the unexplained variation of the model which goes to the error term of the model. The is a moderate and positive correlation between the dependent and independent variables. The apparent prediction error therefore is .618.

5.0 Discussion

Hospital Ownership

The categorical variables of hospital ownership were included to understand the first research question, is there a statistically significant association between hospital ownership (Proprietary, Non-profit, and Government) and LWBS? Although Non-Profit was also a significant predictor of a lower LWBS rate, it did not demonstrate as strong of a significance as Proprietary. Both Proprietary Beta -.078 and Non-Profit Beta -.039 have a negative value demonstrating a lower LWBS % in comparison to the Government reference value with Proprietary with a $p<.05$ using 95% confidence intervals demonstrating the stronger predictor of a lower LWBS percentage rate. We reject the null hypothesis and believe that there is a statistically significant association between hospital ownership and LWBS. Future research is needed to determine other variables that can explain differences in hospital ownership and LWBS rates. A possible explanation that could be researched is if Proprietary hospitals focus more on efficiency and do not want to lose revenue from LWBS rates. Hospital administrators should focus on differences between hospital processes and resources available at Proprietary, Non-Profit and Government hospitals.

EDV

The categorical variables of EDV were included to understand the second research question, Is there a statistically significant association between ED volume (EDV) and LWBS? Medium, High, and Very High categorical values all were significant predictors in comparison to Low volume. As volume increases so does the LWBS rates in hospitals. Of the EDV variables, the Very High beta coefficient is the strongest predictor of the volume variables. We reject the null hypothesis and believe there is a statistically significant association between ED volume (EDV) and LWBS.

Hospital Overall Quality Rating

The categorical variable of Hospital Overall Quality Rating was included to understand the third research question, is there a positive relationship between overall hospital quality score rating (QS) and LWBS? Although the Hospital's Overall Quality Rating demonstrates a lower LWBS rate, ($p>.05$) it is not significant. Therefore, we fail to reject the null hypothesis and believe there is not a positive

relationship between QS and LWBS. We validated in the research what is established in the literature that as EDV increases so does LWBS rates. Additional research needs to be conducted to understand what the differences in processes and resources that are impacting LWBS rates at higher volume centers.

Hospital Type

The categorical variables of hospital type were included in the Bootstrap Method displayed in Table 3. Although a hypothesis and research question were not created, we completed the analysis to better understand if there was a statistically significant association between hospital type and LWBS. The categorical variable of Critical Access was compared to the categorical reference variable of Acute Care Hospitals. Critical Access p=.742 and was not a statistically significant predictor of LWBS rates. More research needs to be conducted to understand differences in hospital type and the potential impact on LWBS. Critical access hospitals are all lower volume and are typically located in more rural areas. It is established in the literature that lower volume EDs and hospitals in more rural areas have lower LWBS rates.

5.1 Limitations

We had an interest in LWBS rates specifically in the Medicare population. The first limitation of the dataset utilized was a CMS dataset which may have potential biases due to the age of the CMS population and therefore may not be representative of the entire U.S. population's ED visits. It is established in the literature that older patients are less likely to LWBS than younger patients and the sampling of CMS data may not be representative of all patients nationally. We recognize the impact that insurance or lack of insurance can have an impact on LWBS rates, but do not know if there is a specific impact of patients that have Medicare and Medicaid on utilization patterns and outcomes specifically related to LWBS which could create a bias. The second limitation to the findings may be that although LWBS rates are defined in the dataset, there may be variability in the collection of the data as some hospital patients may have been seen by a nurse, were triaged, and may have received some care before receiving a medical screening exam MSE from a physician. In some cases, patients

may have had labs, imaging, IV fluids, or medications, before the MSE. The third limitation of the dataset is that the data is self-reported from hospitals and therefore may not be complete or accurate. The fourth limitation of the dataset is that not all variables that impact LWBS rates are measured in the dataset or isolated for comparison to hospital characteristics. In the dependent variable category of LWBS, there are 1797 (38%) hospitals in the dataset that are missing or not classified. The fifth limitation is the dataset is claims-based data which has limitations to be used in research instead of survey data designed for research purposes. The results of this research may not be generalizable to all U.S. patient populations or geographic locations. The research was conducted using data collected in one year and therefore may not reflect patterns of healthcare delivery in different periods. Despite these limitations, there is potential value in utilizing this analysis and framework for future studies of LWBS patients in the CMS population.

5.2 Conclusion

The goal of this paper is to better understand the relationship between hospital characteristics and ED efficiency, as measured by LWBS rates. Although the patient population of LWBS as a percentage is small, it is still a significant issue in U.S Emergency Departments. Approximately 1.7% of patients who visit the ED left without being seen (LWBS) in United States hospitals (Moe & Belsky, 2016). This approximate percentage rate was validated in the research with the LWBS (M=1.39%, SD=1.85%) dependent variable.

As previously stated in this paper, significant variation exists between patient wait times in EDs, which can be impacted by the volume of patients seen, efficiency, ED staffing, admission process, or availability of inpatient beds (Allen, Gian, & Simon, 2022). In the literature, it is established that urban and teaching hospitals with higher volumes > 60,000 visits have higher LWBS (Sheraton, Gooch, & Kashyap, 2020). As we investigated the potential impact of volume on LWBS, we compared low-volume centers to high-volume centers. We identified in our research that Medium, High, and Very

High categorical values all were significant predictors of LWBS in comparison to Low volume. As volume increases so does the LWBS rates in hospitals. It would be helpful in future studies to collect data on staffing levels, ED patient boarding, availability of inpatient beds, and other data that are suggested causes of increased LWBS rates to better understand the differences in relationship to hospital characteristics such as EDV. Other factors were not included in this research that could help us understand the differences in processes that could impact LWBS rates at low-volume centers in comparison to high-volume centers. A retrospective quantitative study was utilized for this study to utilize national data and was easily accessible and able to download. A mixed-method study might provide further insight into factors attributable to hospital characteristics' potential impact on LWBS rates.

Studying hospital characteristics such as ownership and the potential impact on LWBS can provide a framework for future research to understand how hospital processes may vary in proprietary versus not-for-profit and government hospitals' impact on LWBS. In this study, the categorical variable of Proprietary had a significant difference in LWBS rates compared to the reference value of Government. Proprietary hospitals may put more emphasis on efficiency or LWBS rates than not-for-profit or government hospitals.

Hospitals utilize many different metrics to measure quality and efficiency. We were interested in understanding if there was a relationship between the Hospital's Overall Quality Rating. The ordinal variable Overall Hospital Quality Rating ($p=.075$) demonstrates a negative value representing a lower LWBS %. Although the Hospital's Overall Quality Rating demonstrates a lower LWBS rate, $p>.05$ it is not statistically significant. There can be many factors that can impact a hospital's performance on quality and efficiency. The Overall Quality Rating is comprised of 12% of the score based on quality metrics from Timely and Effective Care, however, LWBS is not specifically a variable that is utilized in the Overall Quality Rating. More research needs to be done on the quality and efficiency relationship as

measured by the Overall Hospital Quality Rating and the relationship to LWBS rates to better understand the potential relationship.

Understanding differences in processes, resources, prioritization of outcomes metrics, and other factors that impact LWBS rates could allow for tools and resources to improve efficiency in the ED. Reducing LWBS rates could potentially reduce risk, improve revenue, improve outcomes, enhance patient experience and patient satisfaction. Hospital administrators and providers can utilize LWBS research to be better informed of how hospital characteristics and processes can impact patient care.

The correlational retrospective analysis of national Medicare data has added to the body of knowledge related to the relationships between hospital characteristics and EDV's potential impact on LWBS. The results of the analysis can serve as a reference for future projects related to the LWBS patient population. Understanding statistically significant positive relationships can provide insight into how hospital characteristics can impact LWBS percentage rates. Additional research to expand the knowledge of hospital characteristics and potential changes that can be made is needed. Higher hospital EDV has a statistically significant relationship with LWBS rates. Additional research into the potential causes of LWBS rates in high-volume facilities is needed. Although the hospital characteristic of hospital type was not statistically significant, additional research is needed to understand the differences in hospital type and the potential relationship to LWBS.

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