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Emergency Department Boarding Practices in the United States

Author
Nolan, Jason

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Emergency Department Boarding Practices in the United States

by

Jason Nolan

DISSERTATION

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[redacted]

Dedication

This dissertation is dedicated to the patient I coded in the ambulance bay of the UCSF Emergency Department in the summer of 2007, because we had four codes running simultaneously and there was literally no other available treatment space in the department. The short time we spent together compelled me to pursue this study. I'm sorry we couldn't take better care of you.

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Abstract

Emergency Department Boarding Practices in the United States

By

Jason Nolan

Purpose. This study describes: (1) the practice of emergency department (ED) boarding of medical and mental health patients in the U.S.; and (2) how patient, hospital and community characteristics relate to ED boarding.

Background. ED crowding has been associated with a multitude of negative outcomes. The practice of boarding admitted patients in the ED is a significant factor associated with ED crowding. However, no quantitative analysis has been published that characterizes the extent of these boarding practices. Furthermore, few studies have focused on the population of mental health patients boarding in EDs.

Methods. This study uses data from the 2008 National Hospital Ambulatory Medical Care Survey, a national probability sample of visits to U.S. EDs, to determine the proportion of EDs that board medical and mental health patients, the proportion of patients that are boarded, boarding times for these patients, and the characteristics of patients, hospitals, and community that are associated with boarding.

Results. Bivariate analyses confirmed that boarding was practiced by a majority of EDs in the U.S. in 2008 (57.8%). The proportion of ED visits resulting in boarding was significantly higher for the mental health population (21.5%) than for other visitors (10.3%), and was especially high for the population of homeless mental health patients (43.4%). Mean patient boarding time was also significantly higher for the mental health population (292.7 minutes) compared to other visitors (205.0 minutes). One out of every eight hours of visit time spent in U.S. EDs in 2008 was consumed by boarding. Multilevel regression analyses demonstrated associations between longer boarding times and all mental health patients (1.4 additional hours, $p<0.001$), and especially homeless mental health patients (3.8 additional hours, $p=0.001$).

Discussion. This is the first study known to describe U.S. ED boarding practices on a national level. Several important findings emerged from this study: 1) ED boarding is a nationwide problem; 2) mental health related visits are consistently associated with both a higher proportion of boarding and longer boarding times; and 3) the U.S. is in need of both increased facilities and services, and improved legislation and policies geared toward the mental health population.

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Chapter One: Introduction to the Problem and Study Purpose

Background

Emergency departments (EDs) serve a vital role in society, with the word "emergency" in the name underscoring the nature of the service that is expected. While for most individuals a visit to an ED is a relatively uncommon occurrence, when it does occur, patients depend on the ED to treat them in a timely, efficient and safe manner. However, in the United States (U.S.) over the last 20 years, demand for ED services has increased while the number of EDs has decreased (Institute of Medicine, 2006; Nawar, Niska & Xu, 2007). This imbalance has resulted in what researchers have characterized as a crisis of inability to safely meet demand (Institute of Medicine, 2006), a phenomenon widely known as emergency department crowding (EDC).

Researchers have associated EDC with increased morbidity, mortality and sentinel events (Chalfin, Trzeciak, Likourezos, Baumann & Dellinger, 2007; Pines, Hollander, Localio & Metlay, 2006; The Joint Commission, 2002). One study, based on nationally representative data, found that the number of people seeking emergency care in the U.S., but subsequently leaving before being seen, had almost doubled from 1.1 million visits in 1995 to 2.1 million visits in 2002 (Sun, Binstadt, Pelletier & Camargo, 2007). The authors concluded that, "recent strains on the U.S. ED system are adversely affecting healthcare quality and access" (Sun et al., 2007, p. 211).

At the same time that demand for ED care has increased and ED capacity has decreased, the number of inpatient hospital beds in the U.S. has decreased (American Hospital Association, 2010). Likewise, the number of inpatient psychiatric beds, used to treat patients with mental health and substance abuse (MHSA) conditions, has declined sharply in the U.S. From 1970 to 2003, one government agency found a 62 percent decline in inpatient psychiatric beds per capita, and an 89 percent decline in state and county psychiatric hospital beds per capita (President's New Freedom Commission on Mental Health, 2003). The decrease in psychiatric bed capacity is especially alarming considering that research has demonstrated a surge in MHSA related ED visits during the last decade, from 5.4% of all ED visits in 2000 to 12.5% of all ED visits in 2007 (Hazlett, McCarthy, Londner & Onyike, 2004; Owens, Mutter & Stocks, 2010). Given this decrease in both general inpatient and psychiatric inpatient beds, EDs have had to resort to the practice of boarding these patients until hospital beds become available. It should be noted here that psychiatric patients will be referred to in this study as *mental health and substance abuse* (MHSA) patients, a term used by the Agency for Healthcare Quality and Research in identifying these patients in its Clinical Classification Software tool (used in this study and discussed in greater detail in Chapter Three).

Throughout this dissertation, boarding will be defined as the practice of holding a patient in a department (e.g. the ED) after the decision has been made to either admit the patient to another unit, or transfer the patient to another hospital, due to the lack of an available bed. This includes the practice of boarding psychiatric patients awaiting admission to psychiatric units within hospitals or transfer to external psychiatric facilities. Research has indicated that the practice of ED boarding results in worse outcomes, including death, for boarded patients (Chalfin et al., 2007; Hong et al., 2009), longer waiting times for all other patients, and an increase in the number of ambulances that are diverted to alternate hospitals for emergency treatment (Fatovich, Nagree & Sprivulis, 2005; Schull, Lazier, Vermeulen, Mawhinney & Morrison, 2003).

Statement of the Problem

Studies have demonstrated that the practice of boarding admitted patients in the ED is one of the most significant factors associated with EDC (Fatovich et al., 2005; Forster, Steill, Wells, Lee & Walraven, 2003; General Accounting Office, 2003; Lewin Group, 2002; Lucas, Farley, Twanmoh, Urumov, Olsen et al., 2009; Schull, Lazier et al., 2003). While the practice of boarding admitted patients in EDs has been described in the literature (General Accounting Office, 2003; Institute of Medicine, 2006; Lewin Group, 2008), to this researcher's knowledge no quantitative analysis has been published describing the extent of this practice at the state, regional, or national level in the U.S. Even less is understood about the extent of the practice of boarding MHSA patients, as few research studies have specifically examined this patient population (Lewin Group, 2008).

Purpose of the Study

Study Aims

The purpose of this study is to better understand U.S. ED boarding practices. To meet this purpose, this study has three aims: (1) to determine the extent to which the practice of ED boarding of MHSA patients, as admitted patients and transfer patients, occurs in the U.S.; (2) to determine the extent to which the practice of ED boarding of non-MHSA patients, as admitted patients and transfer patients, occurs in the U.S.; and (3) to describe how patient, hospital and community characteristics relate with ED boarding.

Design

These aims will be addressed by means of analyses of secondary, cross sectional data from the 2008 National Hospital Ambulatory Medical Care Survey (NHAMCS), a dataset containing the variables and data necessary for such a retrospective analysis. The NHAMCS is a national probability sample of visits to the EDs of general and short-stay hospitals, excluding Federal, military and Veterans Administration hospitals, from all 50 states and the District of Columbia. Produced annually since 1992, the NHAMCS is a free, public use dataset sponsored by the National Center for Health Statistics of the National Institutes of Health.

Research Questions

To address the aims, this study will answer the following research questions:

1. What is the proportion of U.S. EDs that board patients?
2. What is the total proportion of visits to U.S. EDs that result in patient boarding, and does this proportion vary by patient type, or by hospital, patient and community characteristics?
3. For those patients who board in U.S. EDs, how long does the average patient board, and does this time vary by patient type, or by hospital, patient and community characteristics?
4. What is the total amount of ED boarding time in the U.S. annually?
5. What are the relationships among patient, hospital, and community characteristics and ED boarding?

Population/Sample/Data

As this study concerns U.S. ED boarding practices on a national level, the population of interest in this study is the entire population of patients who visited U.S. EDs in 2008. Within this population, specific interest is placed on boarded patients, both MHSA and non-MHSA, as boarded admitted patients, boarded transfer patients, and boarded admitted/transfer patients who were ultimately discharged directly from the ED. The NHAMCS allows for the reliable approximation of the entire population of U.S. ED visits for any given year through its complex sampling algorithm and the application of weights. The dataset represents a national probability sample of visits to the EDs of noninstitutional general and short-stay hospitals, excluding Federal, military and Veterans Administration hospitals, from all 50 states and the District of Columbia. It provides estimates in the following priority: U.S., region, ED, and type of ownership. The NHAMCS employs a four-stage probability algorithm, with samples of primary sampling units, hospitals within primary sampling units, emergency service areas within EDs, and patient visits within emergency service areas (CDC, 2008).

Variables

Of the 386 variables describing hospital, ED and visit characteristics contained in the 2008 NHAMCS, only a fraction will be used in this study. The variables of interest, defined and described in Chapter Three, have been grouped into four concepts corresponding to: (1) visit characteristics, (2) hospital characteristics, (3) patient characteristics, and (4) patient’s community characteristics. Among all variables to be studied, of primary interest is whether or not a patient was boarded (a visit characteristic), and if so, the amount of time spent boarding. Variables representing patient, hospital and community characteristics will then be used to better understand any differences that exist among these boarded patients.

Significance

While a handful of studies, both in the U.S and abroad, have found the practice of boarding admitted patients in the ED to be associated with EDC (Fatovich et al., 2005;

Forster et al., 2003; General Accounting Office, 2003; Lewin Group, 2002; Lucas, Farley, Twanmoh, Urumov, Olsen et al., 2009; Schull, Lazier et al., 2003), no study has examined the extent of this practice in the U.S. on a national level. Leading nursing and medical associations including the Emergency Nurses Association, the American College of Emergency Physicians, and the American Academy of Emergency Medicine have issued position statements calling for policy, research and administrative efforts aimed at reducing EDC (American College of Emergency Physicians, 2006; Eitel, Rudkin, Malvehy, Killeen & Pines, 2010; Emergency Nurses Association, 2006). In these position statements, admitted patient boarding is emphasized as a major contributor to EDC; yet there has been no comprehensive quantitative analysis of admitted patient boarding in the U.S. using a dataset capable of producing national estimates. At this juncture, such a study is necessary to determine whether the current direction of research and policy is appropriate.

The practice of boarding MHSA patients in the ED is likewise an important phenomenon to explore. It is similar to the practice of boarding other admitted patients, i.e., an ED bed is occupied by a non-ED patient for an unspecified amount of time (Lewin Group, 2008). However, in hospitals without psychiatric wards, and in hospitals with psychiatric wards but no vacancies, boarded MHSA patients are routinely transferred to other hospitals for psychiatric care (Lewin Group, 2008; Lewin Group, 2009; Lipton, 2007). In some cases, boarded MHSA patients are discharged directly from the ED after days or even weeks because admission or transfer to a psychiatric ward was never secured (Lewin Group, 2008; Lewin Group, 2009). Because of this, the total U.S. population of boarded MHSA patients is made up of boarding MHSA admitted patients, boarding MHSA transfer patients, and boarding MHSA patients who are ultimately discharged directly from the ED. Similar to the lack of knowledge about boarding admitted inpatients in the ED, no study has examined the practice of boarding MHSA patients in the ED at the state, regional or national levels (Lewin Group, 2008).

Some evidence suggests this group of patients may represent a significant portion of overall ED boarding time. In a recent study published by the Agency for Healthcare Research and Quality (AHRQ), researchers found that one out of every eight ED visits involved a MHSA condition, with 41 percent of these visits resulting in hospitalization (Owens, Mutter et al., 2010). Other researchers have concluded that boarded MHSA admitted/transfer patients require more resource-intensive care, have longer boarding times than other boarded patients, and receive substandard care while in the ED (American College of Emergency Physicians, 2008; Lewin Group, 2008; Lewin Group, 2009; Owens, Mutter et al., 2010). All of these factors indicate that the practice of ED boarding is not a good solution for this patient population.

This study will fill several important gaps in the body of knowledge about EDC. By determining the extent to which admitted patients are boarded on a national level, this study will help establish whether the positions of leading national organizations on the issue of EDC are well informed. Additionally, this study will be the first to describe the extent of the practice of boarding MHSA admitted/transfer patients in the U.S., data that could prove useful to researchers and policymakers. Finally, by describing the relationship between patient, community, and hospital characteristics and ED boarding, this study has the potential to inform the research community about associations that have not been examined. Such relationships, if they exist, have the potential to identify important trends that could aid in honing policy, research and administrative decisions. For instance, trends such as regional differences in boarding practices, racial disparities, or differences in boarding practices at certain types of hospitals could be identified.

EDC has been characterized by experts in both the U.S. and other developed countries, such as Australia and Ireland, as the most serious issue confronting EDs today (Fatovich, 2002; Gilligan et al., 2008; Institute of Medicine, 2006), and patient boarding has been increasingly identified as the most significant factor contributing to EDC (Fatovich et al., 2005; Forster et al., 2003; General Accounting Office, 2003; Lewin Group, 2002; Lucas, Farley, Twanmoh, Urumov, Olsen et al., 2009; Schull, Lazier et al., 2003). The existing model of serving communities' emergency healthcare needs through hospital-based EDs is being compromised because of EDC. Interventions must be devised and implemented to improve current conditions and allow EDs to function in the manner for which they were designed. Before progressing further, it is necessary to reexamine ED boarding practices to ensure that current research and policy directions are well informed.

Chapter Two: Conceptual Framework and Literature Review

Conceptual Framework

Emergency department crowding (EDC), like most complex issues, is perhaps best understood through the lens of a conceptual framework that distills the phenomenon into more comprehensible concepts and organizes them into a model with the power to explain the problem and serve as a guide for research. According to Fawcett, a conceptual framework "gives direction to the search for relevant questions about phenomena and suggests solutions to practical problems" (1995, p. 3). In attempts to explain EDC and guide research related to the phenomenon, to this author's knowledge, three such conceptual frameworks currently exist (Asplin et al., 2003; Schull, Slaughter & Redelmeier, 2002; Richardson, Ardagh & Gee, 2005). Of the three, the Input-Throughput-Output Conceptual Model of ED Crowding by Asplin et al. (2003) is the only one created specifically to understand EDC in the U.S. healthcare system, and represents a broader, more adaptable, and more universal conceptual framework than the other models. Because of these traits, this framework was selected as the basis for an adapted model of EDC to be used as a guide for this dissertation. The model in its original form appears in Appendix A (Asplin et al., 2003).

The Input-Throughput-Output Conceptual Model of EDC

In the model by Asplin et al. (2003), EDC is comprised of three interdependent concepts: input, throughput, and output. The concept of input includes factors that create demand for ED services; throughput includes factors that relate to efficiency and effectiveness of ED care processes, especially concerning length of patient stay and resource utilization; and output includes factors related to patient discharge from the ED to the ambulatory care system, admission to the hospital, or transfer to another facility. The graphic representation of the model (see Appendix A) presents a visualization of each concept and the relationships between concepts, as well as the temporal flow through the acute care system and the bottlenecks that might be encountered (Asplin et al., 2003). The model's creators provide a brief explanation regarding its design, "The model is based on engineering principles from queuing theory and compartmental models of flow, dividing ED functioning into input, throughput, and output stages" (Solberg, Asplin, Weinick & Magid, 2003, p. 825). Queuing theory traces its roots to the study of telegraphing queues in the late 19^{th} century (Daigle, 2005), with pioneers in the field using mathematical models to determine the number of switches necessary to handle inbound traffic on a switchboard (Tucker, Barone, Cecere, Blabey & Rha, 1999). Queuing theory has been widely adopted by industrial engineers, and has been applied to the study of queues for hospital beds (Gorunescu, McClean & Millard, 2002; Tucker et al., 1999). Forster et al. (2003) provide a clear and succinct description of the application of queuing theory to EDC:

> 'Queuing theory' states that increased utilization leads to increased numbers of people waiting in a queue and increased waiting time for new clients. Theoretically, queues grow even when capacity is submaximal because the arrival intervals between clients vary; some clients take longer to complete services, and some clients require special services. Extending this theory to the ED, waiting time may increase when there is submaximal hospital occupancy because some patients need care in specialized units, such as oncology wards or those with

> telemetry. These may be fully occupied even when there is still a lot of capacity in the hospital as a whole (p. 131).

This description of the application of queuing theory to EDC highlights the importance of access to inpatient beds, and beds in “specialized units” such as psychiatric units, within the overall phenomenon of EDC. Without access to beds, ED boarding of these patients occurs, as shown in the model (see Appendix A).

The Adapted Conceptual Framework of EDC

Since the publication of the original model, much of the research concerning EDC has focused on determining which factors constitute the most significant causes of the problem, and which factors have the most pronounced effects. A growing body of research points to the practice of ED boarding of admitted patients as the single greatest cause of EDC (Fatovich et al., 2005; General Accounting Office, 2003; Lewin Group, 2002; Lucas, Farley, Twanmoh, Urumov, Olsen et al., 2009; Schull, Lazier et al., 2003), and as a cause associated with negative patient outcomes (Chalfin et al., 2007; Hong et al., 2009). However, one of the weaknesses of the Input-Throughput-Output Conceptual Model of ED Crowding (Asplin et al., 2003) is its inability to distinguish the relative degree of importance among the concepts it describes. While the model may not need to distinguish the relative degree of importance of all the concepts it encompasses, ED boarding of admitted patients is believed to be such an important determinant of EDC that it warrants some form of distinction within the model. This distinction is reflected in the insertion of the “boarding load” in the Adapted Conceptual Framework of EDC (Appendix B).

Similarly, the practice of ED boarding of transfer patients, especially MHSA patients, while they await transfer to another facility is like the practice of ED boarding of admitted patients, i.e., the patient remains in the ED while awaiting a bed elsewhere (Lewin Group, 2008; Lewin Group, 2009; Lipton, 2007). However, transfer patients are generally classified or coded differently than admitted patients, and because of this subtle difference, their impact on EDC may be unmeasured in the research (Lewin Group, 2008). To account for this important distinction, the output phase in Appendix B demonstrates an amended workflow, with separate terminal paths for boarding of admitted patients and transfer patients. Within the adapted model, boarding of transfer patients also falls within the "boarding load" box in order to highlight the similar impact of these two populations on EDC.

Additionally, several researchers have recently drawn attention to the practice by hospitals of rationing scarce hospital beds to patients being admitted after elective surgical procedures over patients being admitted from the ED (Bayley et al., 2005; Falvo et al., 2007; General Accounting Office, 2003; Henneman, Lemanski, Smithline, Tomaszewski & Mayforth, 2009; Lucas, Farley, Twanmoh, Urumov, Evans et al., 2009). While the conceptual model in its original form does account for the lack of staffed inpatient beds as a cause for ED boarding of admitted patients, a more explicit modeling of the concept of rationing of beds would improve the model's fit to current practices. This update to the model is reflected in Appendix B.

Another set of amendments has been made to more accurately reflect the results of certain actions and conditions inherent to EDC. The first regards ambulance diversion. Asplin et al. (2003) state, "Another marker of EDs being unable to meet patient demand is ambulance diversion. An ED that diverts ambulances has signaled that it is no longer safely able to care for another critically ill or injured patient" (p. 178). Accordingly, the original model by Asplin et al. (2003) displays ambulance diversion as a box that appears to deflect demand for ED care away from the throughput phase. However, the ambulance patient still exists, and one ED's loss is another's gain: ambulance diversion simultaneously decreases demand for care at a crowded ED while increasing demand for care at an alternate ED. Thus, a circled arrow has been added to the model between demand for ED care and ambulance diversion to demonstrate the reciprocal nature ambulance diversion has on ED demand (see Appendix B). Also, the path reflecting a patient's lack of access to follow up care following discharge to the ambulatory care system has been changed to terminate in the input factor of safety net care rather than in the throughput factor of arrival in the ED, as this more accurately represents the patient's trajectory (see Appendix B). Similarly, for patients who leave without completing treatment, a pathway for returning to the ED, resulting in increased demand for ED care, has been added to the model (see Appendix B), as research has shown that many of these patients subsequently return to the ED (Rowe et al., 2006).

Finally, perhaps the single greatest strength of the original model is its potential to inform research, public policy and practice. One reason for this is the model's nesting within the construct of the acute care system, with corresponding links to larger policy systems having the potential to greatly impact EDC. As a maturing phenomenon, many of the simpler, more feasible, and least expensive solutions to EDC have already been implemented, with potential remaining solutions likely to require the greatest efforts. It is because of this that the model's bridge to public policy needs to be even more pronounced and explicit.

The recent focus on healthcare reform in the U.S., including the passage of the Affordable Care Act of 2010, has underscored the need for legislative policy changes to improve the overall healthcare system. Public policy changes have the potential to greatly impact EDC on both the input and output phases. Reducing barriers to access to care, such as lack of healthcare insurance or lack of a primary care provider, could potentially reduce upstream flow to the ED by: (1) diminishing the ED's role as a safety net care provider for non-emergent conditions by establishing access to more appropriate primary care providers; and (2) improving the overall health of the population through the benefit of access to preventive and routine care, thereby decreasing the volume of patients presenting to the ED because of simple or chronic conditions that deteriorate into emergency conditions (Burt & Arispe, 2004).

On the output phase, the issue of ED boarding of transfer patients is governed by the Emergency Medical Treatment and Labor Act (EMTALA) of 1986 (U.S. Code Collection, 1986). While EMTALA clearly mandates that all U.S. EDs accept and treat patients with MHSA emergencies, the law is much more vague as to the requirement for psychiatric hospitals to accept these patients from EDs after they have been medically cleared and determined to require hospitalization solely for MHSA treatment (Lipton, 2007). As a result, MHSA transfer patients routinely board in EDs for days, weeks, or even months while awaiting transfer to a psychiatric hospital (McGee & Kaplan, 2007; Lewin Group, 2009; Pedroja, 2008). This situation can cripple an ED, as described in a qualitative study by McGee and Kaplan:

> In some places the overcrowding is worsened by the fact that we have a huge psychiatric population that has no place to go so the overcrowding gets worse. At some of the campuses we have it's not unusual for them to be boarding 6, 7, or 8 psych patients for 3, 4, or 5 days so that takes up one-third of your emergency department (2007, p. 445).

According to a recent study conducted by the Lewin Group for the U.S. Department of Health and Human Services, there is evidence that hospitals are aware of the need for legislative review of these policies, as some hospitals in that study "tracked data on psychiatric boarders generally to show legislators and other stakeholders that psychiatric boarding was a problem in their hospitals" (Lewin Group, 2009, p. 5). A review of EMTALA and improvements to the legislation that governs ED transfers, and MHSA transfers in particular, could go far toward improving efficiency in the output phase of the EDC model.

Thus, legislative changes have the ability to impact both the input and output phases of EDC. Accordingly, in order to more directly position EDC within the realm of such legislation, and potential high-impact improvements, the healthcare system has been added to the model as an overarching construct. Appendix B reflects this amendment to the model, which more clearly demonstrates EDC manifesting within the acute care system, and the acute care system operating within the healthcare system.

It is important to point out that not all elements of the adapted model will be used in this study. On the contrary, consistent with the purpose of this study as outlined in Chapter One, the study will focus only on variables associated with boarding (a visit characteristic), and with certain patient, community, and hospital characteristics. These variables, determined by the research questions being posed, will be described in greater detail in the Chapter Three; however, it should be noted here that a limitation of this study, as is the case with most analyses which rely on secondary data, is its ability to take advantage of only those variables available in the original dataset.

Empirical Background

Literature Search Strategy

A search for research articles concerning EDC was performed in the PubMed database using broad search terms in an effort to capture the highest number of relevant articles. The following search terms were used: "emergency medical services" [MeSH Terms] AND "crowding" [MeSH Terms]. These parameters yielded over 350 abstracts, from which, articles were selected for further reading based on the following criteria: (1) English language; (2) research study or literature review (as opposed to commentary, opinion, editorial or letter); and (3) EDC as the primary study focus. Additionally, articles not captured in the initial PubMed search were garnered from the references of the articles reviewed. Inclusion criteria for this review of literature were as follows: (1) focus on antecedents of EDC; (2) focus on outcomes associated with EDC; (3) well described methods; and (4) findings added knowledge to understanding about EDC. Exclusion criteria included: (1) pilot study; (2) main focus on an aspect of EDC outside of the hospital (e.g., prehospital provider safety, urgent care clinic efficiency, etc.); and (3) sole focus on solutions to EDC.

Definitional Inconsistencies in the Literature

Despite being a worldwide problem, and the subject of extensive study for over a decade, EDC remains so complex that researchers have still failed to come to a consensus on how it should be conceptually and operationally defined. One literature review cited 23 different definitions in use in the professional literature, listed in Table 1 below (Hwang & Concato, 2004). As Table 1 shows, the lack of a consensus has resulted in a wide range of operational definitions that include prominent antecedents of EDC, consequences of EDC, and even combinations of antecedents and consequences.

Table 1. *Definitions of EDC found by Hwang & Concato (2004)*

1. Real-time computerized tracking of waiting times, treatment times, and current census of actual patients in the ED being treated or waiting to be seen.
2. Number of visits >120/d (840/wk).
3. Lack of capacity in observation area.
4. Response of nurses' and physicians' opinions of ED overcrowding and feeling of being rushed.
5. ED bed ratio, acuity ratio, provider ratio, demand value.
6. Patients wait >30 min, or all ED beds filled >6 h/d, or patients placed in ED hallway, or physicians rushed.
7. Patients wait >30 min, patients wait >60 min, ED beds filled >6 h/d, patients placed in hallways >6 h/d, waiting room filled >6 h/d, physicians feel rushed >6 h/d.
8. Patients wait >60 min to see physician, ED beds full >6 h/d, patients placed in ED hallways >6 h/d, emergency physicians feel rushed >6 h/d, waiting room filled >6 h/d.
9. When there are no available in-hospital beds for patients admitted from the ED.
10. ED crowding occurs when ED patients are ready but unable to be admitted to either a floor or an ICU bed and are held in the ED.
11. Reduction of inpatient beds and a critical shortage of health care professionals.
12. When admitted ED patients cannot leave the department because all staffed inpatient and ICU hospital beds are occupied and no beds are available in neighboring facilities for transfer.
13. From boarding inpatients already admitted to the hospital for hours to several days.
14. When patients needing admission cannot leave the ED because of unavailability of inpatient beds.
15. When admitted ED patients cannot leave the department because all staffed inpatient and ICU beds in the hospital are occupied and no beds are available in neighboring facilities for transfer.
16. When acute care beds become filled.
17. When the delay in transfer of admitted patient to a hospital bed is longer than 4 h.
18. (Admitted) patients held overnight in the ED.
19. Too many sick patients, and too many admitted patients.
20. Periods of ambulance diversion.

21. Patients wait >90 min, ED beds filled >6 h/d, >30% ED beds filled with admitted patients, patients in hallway >6 h/d, full waiting room >6 h/d.
22. Registered ED patients who Leave Without Being Seen (LWBS), and frequency and duration of EMS diversion.
23. Staff shortages, lack of available beds, poor operational process, increased number of patients who seek care, lack of universal access, shortage of inpatient beds, and hospital closures.

For the purposes of this study, EDC will be conceptually defined as the phenomenon that occurs, “When the identified need for emergency services exceeds available resources for patient care in the emergency department, hospital, or both” (American College of Emergency Physicians, 2006, p. 585). This definition appropriately recognizes that factors outside of the ED play a crucial and integral role in the problem.

Expert consensus regarding a common “gold standard” metric for measuring the phenomenon has likewise proven difficult. Some of the most prevalent metrics for measuring EDC in the literature are defined in Table 2 below. In the absence of a “gold standard” operational definition, the metrics below have served as the most common measures of EDC in the research to date. Some of these metrics will be addressed later in this chapter, and several will also be used in this study (to be discussed in greater detail in Chapter Three).

Table 2. *Common Metrics Used in Studies of EDC*

Metric	Definition
Access block	An admitted patient who spends more than eight hours in the ED.
Ambulance diversion time	The aggregated number of hours (per day/week/month/year) an ED spends diverting ambulances to other hospitals because of lack of capacity to safely accept additional ambulance patients.
ED boarding	The practice of holding a patient in the ED after the decision has been made to either admit the patient to the hospital or transfer the patient to another institution, due to lack of an available bed.
ED LOS	ED Length of Stay: a patient’s total time in the ED from arrival to departure.
ED patient hours	The sum of hours for all patients present in the ED.

ED waiting room census	The number of patients in the ED waiting room who are awaiting placement in a licensed treatment area.
EDWIN	The Emergency Department Work Index (EDWIN), a complex measurement tool developed as a gauge of EDC (Bernstein, Verghese, Leung, Lunney & Perez, 2003). The EDWIN formula appears in Appendix C.
NEDOCS	The National Emergency Department Overcrowding Scale (NEDOCS), a complex measurement tool developed as a gauge of EDC (Weiss et al., 2004). The NEDOCS formula appears in Appendix D.
Occupancy level	A simple measurement tool developed as a gauge of EDC (Hoot, Zhou, Jones & Aronsky, 2007). The Occupancy Level formula appears in Appendix E.
Patient waiting time	The time from arrival in the ED to time of first contact with a physician.
Percent of patients who leave without being seen	The percentage of patients (per day/week/month/year) presenting to an ED for evaluation who subsequently leave the ED prior to receiving a medical screening examination.
Total ED occupancy	Proportion of available bed hours per month occupied by patients.
Total ED volume	Total number of patients in the ED.

Negative Outcomes Associated with EDC

While the current threads of EDC can be traced back to seminal articles describing the problem as early as 20 years ago (Andrulis, Kellermann, Hintz, Hackman & Weslowski, 1991; Gallagher & Lynn, 1990), an understanding of the profound effects of EDC has only more recently begun to coalesce. This lag is likely the result of the natural order of development of understanding about any novel phenomena, whereby problems must be shown to be systematic in order to warrant research, and then definitions must be agreed upon, metrics for measurement must be created, and studies must be designed and conducted. Now, 20 years after the problem was first described, there is a substantial body of literature that convincingly supports the conclusion that EDC is associated with negative outcomes.

It could be argued that the worst consequence of any health care phenomenon is the death of a patient, thus in a discussion of the outcomes associated with EDC, increased mortality seems an appropriate starting point. In one of the earliest studies to describe the relationship of EDC to patient mortality, Miró et al. (1999) found that higher weekly visit volume was associated with increased patient mortality. Other researchers have found associations between high ED occupancy rates and increased mortality (Richardson, 2006; Sprivulis et al., 2006), as well as associations between prolonged length of stay (LOS) in the ED and increased mortality (Chalfin et al., 2007; Hong et al., 2009). In the most noteworthy of these studies, Chalfin et al. (2007) analyzed data spanning four years for 50,322 ED patients destined for the intensive care unit (ICU), using a multicenter database from 90 participating hospitals (Chalfin et al., 2007). The authors found patient mortality to be associated with delayed admission, defined as ED LOS greater than or equal to six hours from time to decision to admit to the ICU (OR of hospital survival for delayed admission 0.709, 95% CI 0.6– 0.9).

Another study tested the association between EDC and pediatric inpatient mortality (Shenoi et al., 2008). In this study, the researchers assumed EDC if a pediatric patient’s time of admission was overlapped by a period of ambulance diversion by at least 30 minutes. The authors found no association between ambulance diversion overlap and pediatric inpatient mortality, an important finding considering the study included 63,780 patients from 11 Houston-area EDs over an approximately two and a half year period. While this finding is notable, it is the only published study known to this researcher with contrary findings about the positive correlation between EDC and patient mortality.

Patient mortality is not the only negative outcome to be associated with EDC. Researchers in three studies found inverse associations with the likelihood of receiving antibiotics for pneumonia in a timely fashion and either longer ED LOS, higher waiting room occupancy, higher total ED volume, or a greater number of patients ultimately admitted (Fee, Weber, Maak & Bacchetti, 2007; Pines et al., 2006; Pines et al., 2007). In four studies, researchers found EDC to be associated with negative outcome measures in cardiac patients. In two of these studies, EDC was measured by the presence of ambulance diversion, and it was found to be associated with treatment delays in cardiac patients, both in total out of hospital time, and in door-to-needle time for thrombolytic administration (Schull, Morrison, Vermeulen & Redelmeier, 2003; Schull, Vermeulen, Slaughter, Morrison & Daly, 2004). In the third study, the authors demonstrated correlations between higher ED waiting room census and higher patient hours (defined as the sum of hours for all patients present in the ED) and several measures of adverse cardiovascular outcomes, specifically cardiac arrest, hypotension, heart failure and dysrhythmias (Pines, Pollack et al., 2009). In the fourth study, researchers used the Emergency Department Work Index, a previously developed measurement tool for estimating the degree of crowding (Bernstein, Verghese, Leung, Lunney & Perez, 2003), and found an association between crowding and delays in percutaneous coronary intervention for acute myocardial infarction (Kulstad & Kelley, 2009).

In other studies, researchers found statistically significant associations between various EDC measures and negative outcomes such as delayed analgesic treatment of pain (Mills, Shofer, Chen, Hollander & Pines, 2009; Pines & Hollander, 2008), decreased patient satisfaction (Pines et al., 2008), longer inpatient LOS (Krochmal & Riley, 1994;

Liew, Liew & Kennedy, 2003), missed medications and overlooked lab results (Liu, Thomas, Gordon, Hamedani & Weissman, 2009), delays in results of diagnostic imaging (Mills et al., 2010), disparities in timely access to care for the poor and the uninsured (Burt & Arispe, 2004; Lambe et al., 2003), racial disparities in ED LOS (Pines, Localio & Hollander, 2009), lost hospital revenue (Bayley et al., 2005; Falvo et al., 2007), and the opportunity to see additional ED patients (Lucas, Farley, Twanmoh, Urumov, Evans et al., 2009). While this is not a comprehensive listing of the negative patient outcomes that have been associated with EDC, it does provide a window into the breadth of the problems related to EDC.

Input, Throughput and Output: Understanding the Antecedents of EDC

As described in the Conceptual Framework section above, the Adapted Conceptual Framework of EDC (see Appendix B) serves as a useful model for understanding the overall phenomenon of EDC. This framework will be used to categorize various antecedents of EDC and characterize their relationship to the phenomenon.

Input. As shown in Appendix B, the three input components comprising demand for ED care are (1) safety net care, (2) unscheduled urgent care, and (3) emergency care. Among these inputs, emergency care is the component for which EDs were designed, with safety net care and unscheduled urgent care being potentially reducible inputs. As will be discussed below, studies have shown that unscheduled urgent care is not significantly associated with measures of EDC, and there is currently a gap in the literature regarding the impact of safety net care on EDC.

One study at a tertiary care university teaching hospital in Turkey investigated the impact of unscheduled urgent care users on EDC, measured by mean ED LOS (Oktay, Cete, Eray, Pekdemir & Gunerli, 2003). The authors defined unscheduled urgent care users as “inappropriate users” who preferred ED care because of “its proximity, satisfaction with care, worsening symptoms, and unavailability of care in a regular clinic” (p. 585). The authors concluded that, although unscheduled urgent care utilization was high, its impact was low, as inappropriate users had relatively short stays compared to the group of appropriate users (mean length of stay in minutes 65.8±45.5 vs. 203.8±213.8, $t=17.35$, $p<0.001$). While this was a relatively small study (1,155 subjects) conducted over a short timeframe (two weeks), two larger studies have corroborated these findings.

In a time series analysis of 37,999 visits spanning one year at the ED of a large tertiary care hospital in Ontario, Canada, researchers tested not just whether unscheduled urgent care visits had an impact on crowding, but whether the whole category of “walk-in patients” (as opposed to those arriving by ambulance) was associated with EDC (Schull, Lazier et al., 2003). In the study, EDC was measured by hours of ambulance diversion, and the authors found that the entire population of walk-in patients was not associated with ambulance diversion. To explain this finding, they suggested that the lower acuities, faster workups, and lower admission rates of these “walk-in patients” resulted in a lower impact on the department when compared to ambulance-delivered patients with higher acuities and higher admission rates. Similar conclusions were made by Fatovich et al. (2005) in a two-year retrospective analysis of 259,580 visits spanning three major metropolitan EDs in Australia. The authors found no correlation between unscheduled urgent care visits and three of the most commonly accepted measures of EDC: ambulance diversion, ED occupancy, and waiting time. These studies suggest that focusing on the input component of unscheduled urgent care does not hold much potential in improving EDC.

It is important to point out that the studies by Schull, Lazier et al. (2003) and Fatovich et al. (2005) were conducted in countries with universal access to health care systems. Thus, the findings from those studies are not applicable to the input component of safety net care. The concept of safety net care is particular to the U.S. health care system, and represents a situation described by Asplin et al. (2003) that occurs when, “Disproportionate numbers of Medicaid beneficiaries and uninsured individuals frequently rely on the ED as their usual source of care, often because cost or access barriers interfere with receiving care elsewhere” (p. 176). As stated above, there is currently a gap in the literature regarding the impact of safety net care on EDC. One study in the U.S. investigated the prevalence and appropriateness of visits by homeless patients to EDs on a national level (Hauser, 2007), perhaps a useful proxy measure of whether safety net care could be further classified as unscheduled urgent care or emergency care. Using data from the 2005 NHAMCS, Hauser (2007) determined that, while the homeless population utilized the ED more frequently than the non-homeless population, they did not utilize the ED for non-urgent visits in a greater magnitude than the non-homeless population. Further insight into the magnitude of safety net care as an input component can be found in a study by Li et al. (2007), who compared rates of ED usage in populations with and without universal access to health care. In a study comparing large, nationally representative samples of ED visits between the U.S. and Canada in 2003, Li et al. (2007) found virtually identical rates of utilization (39.9 visits per 100 population in the U.S. versus 39.7 visits per 100 population in Canada). Unfortunately, neither of these studies measured the association between the safety net care population and measures of EDC. Future study is needed to better understand this relationship.

Throughput. Referring again to Appendix B, the throughput component of EDC describes factors associated with patient length of stay in the ED, and includes both human and physical resources, and ED systems and processes (Asplin et al., 2003). Whereas the input component of EDC has a focus on patient volume, the throughput component of EDC concerns efficiency and effectiveness. As will be discussed below, researchers investigating antecedents of EDC from the throughput component have found mixed results.

The U.S. is experiencing a nursing shortage, and its need for nurses is also draining the nursing workforce from other nations (Aiken, 2007). However, the current shortage does not represent a novel problem in the history of EDC; 20 years ago, one of the earliest papers to address EDC listed the shortage of registered nurses as one of the key antecedents of crowding (Gallagher & Lynn, 1990). Accordingly, a discussion about throughput antecedents of EDC would be remiss if it failed to address studies examining the association between staffing factors and crowding measures. Two studies have specifically investigated these relationships.

Both Lambe et al. (2003) and Schull, Lazier et al. (2003) tested for associations between staffing measures and crowding measures. A common staffing measure in both studies was nurse staffing levels, and though both studies used different crowding measures, neither found an association between EDC and nurse staffing. Lambe et al.

(2003) investigated 1,167 visits across 30 California EDs, measuring EDC through longer patient waiting times, with waiting time defined as time from arrival in the ED to time of first contact with a physician. The authors found EDC to be strongly associated with lower ratios of ED physicians to patients, and with lower ratios of *triage* nurses to patients, but the overall ratio of nurses to patients was not found to have a significant correlation to patient waiting times (Lambe et al., 2003). Likewise, Schull, Lazier et al. (2003) found no association between ED nurse hours and EDC (as measured by hours of ambulance diversion). The researchers also looked at the performances of 15 attending emergency physicians to assess any correlation between the characteristics of the physician on duty and EDC, again measured by hours of ambulance diversion; they found no such relationship (Schull, Lazier et al., 2003).

Turning to other throughput variables, in a prospective study of 1,589 patients seen over a ten week period at an academic, urban tertiary care ED in the U.S., Kelen, Scheulen & Hill (2001) investigated the impact of a newly opened ED managed acute care unit (ACU) on EDC. Kelen et al. (2001) measured EDC by: (1) ambulance diversion time and (2) percentage of patients who left without being seen (LWBS). The ACU was designed to accept ED patients who would likely require evaluation for more than four hours, such as patients with extensive diagnostic workups or observation protocols; therefore, this study has the potential to serve as a gauge of the effect on EDC of efficient management of patients anticipated to have the largest impact on throughput. Kelen et al. (2001) found that LWBS rates dropped from 10.1% of the daily census in the two weeks before the ACU opened, and 9.4% one year before the study, to 5.0% ($p < 0.05$), despite a 9.0% increase in patient volume from a year earlier. Likewise, ambulance diversion decreased from 98 hours in the two weeks before the ACU opened to 30 hours after opening ($p < 0.05$). Comparisons of a six month pre-opening period and two month post-opening period showed that ambulance diversion decreased by 40%, whereas at four neighboring hospitals, ambulance diversion increased by 44% during the same period. It could be argued that these results are more reflective of increased capacity (also a throughput component) than efficiency. The authors addressed this point, citing the fact that they had increased ED capacity by seven beds only two years before, but had actually seen increased LWBS rates and unaffected ambulance diversion times after that expansion (Kelen et al., 2001).

Output. Referring again to Appendix B, the output component of EDC describes factors associated with a patient's exit from the ED, and concerns ED, hospital and community factors (Asplin et al, 2003). As will be discussed below, researchers investigating antecedents of EDC from the output component have published persuasive results. A significant output factor associated with EDC is the inability to admit a patient to the hospital, or transfer a patient to another facility, after such dispositions have been made in the ED. This situation results in the practice of boarding patients in the ED. In the case of admitted patients, boarding occurs because of the lack of an available inpatient bed at the time of decision to admit (Asplin et al., 2003). In the case of transfer patients, boarding results from the lack of bed availability at the accepting facility, or the inability to locate a facility willing to accept the patient (Lewin Group, 2008; Lewin Group, 2009; Lipton, 2007). To further define and categorize boarded patients, depending upon the availability of services, two hospitals might classify the exact same boarded patient in different ways. This is the case for boarded MHSA patients awaiting treatment in a psychiatric unit: if a hospital has a psychiatric unit, the patient would be classified as a boarded admitted patient, while if the hospital has no psychiatric unit, the patient would be considered a boarded transfer patient (Lewin Group, 2008; Lewin Group, 2009; Lipton, 2007).

In the studies by Fatovich et al. (2005) and Schull, Lazier et al. (2003) described in the *Input* section above, the authors both found significant correlations between ED boarding and EDC measures. Fatovich et al. (2005) investigated access block (the Australian term for ED boarding), defined as "an admitted patient who spends more than eight hours in the ED" (p. 352). They tested for associations between access block and three of the most commonly used indicators of EDC—ambulance diversion, ED occupancy, and waiting time—and found access block to be strongly correlated to all three measures (ambulance diversion: r=0.75, 95% CI 0.49-0.88, $p < 0.001$; ED occupancy: r=0.96, 95% CI 0.91-0.98, $p < 0.001$; waiting time: r=0.83, 95% CI 0.65-0.93, $p < 0.001$). Similarly, Schull, Lazier et al. (2003) found a significant association between the number of admitted patients boarding in the ED and ambulance diversion. They found that for every admitted patient boarded in the ED, there was an additional 6.2 minutes (95% CI 2.6-9.8) of ambulance diversion time per eight hour shift.

Another study investigated the cause of increased ED LOS. Lucas, Farley, Twanmoh, Urumov, Olsen et al. (2009) found a significant positive relationship between median ED LOS and ICU census, cardiac telemetry census, and the percentage of ED patients admitted each day. The authors found no relationship between ED LOS and ED volume. These findings imply that the number of patients an ED sees in a given day is not correlated with crowding; rather, EDC is associated with the inability to advance admitted patients to their destination outside of the ED. Similar findings were published in a report on the American Hospital Association's Survey of ED and Hospital Capacity, where the authors found that the most cited reason for ED diversion was the lack of available critical care beds (Lewin Group, 2002). Moreover, the Institute for Healthcare Improvement (IHI) made the following statement in a 2003 white paper,

> The so-called "ED problem," however, is actually a system problem. EDs do not exist in isolation, but are part of a system of care through which patients flow. Increasing capacity in the ED to accommodate more patients, a solution chosen by many hospitals, is like broadening only the large end of a funnel. Increasing input without facilitating a smooth exit (in this case, transfer to other hospital units) worsens the problem (IHI, 2003, p. 2).

This statement highlights a particularly noxious feature of ED boarding: solutions that aim to address EDC without simultaneously addressing boarding have the potential to amplify the problem.

Additionally, the practice of ED boarding appears to be increasing. One recent Canadian study sought to describe the degree and trends of EDC at a typical academic, urban, tertiary care hospital (Bullard et al., 2009). The authors reported consistent ED patient volume over the study period (about 50,000 visits per year), while finding that boarding times had steadily increased each year, almost linearly, from 43,110 hours per year in 2000-2001 to 118,741 hours in 2006-2007. For the patient cohort of 2006-2007, Bullard et al. (2009) reported 12,017 admitted patients boarding an average of 9.88 hours each, or 2.37 hours for each patient seen in their ED that year. In Australia, in a study from a similar hospital (academic, urban, tertiary care, about 50,000 visits per year), researchers found that the percentage of ED patients waiting greater than eight hours for admission rose from 7.3% in 1999-2000, to 12.2% in 2000-2001, to 20.9% in 2001-2002 (Fatovich & Hirsch, 2003). Likewise, in the U.S., in a landmark report by the General Accounting Office (GAO) about the state of EDC in 2003, boarding of admitted patients was the most commonly cited reason for crowding (GAO, 2003). In their report, based on a survey of 1,489 short-term, nonfederal, general medical and surgical hospitals with EDs located in metropolitan areas across all 50 states, the GAO (2003) concluded the following:

> The factor most commonly associated with crowding was the inability to transfer emergency patients to inpatient beds once decisions had been made to admit them as hospital patients rather than to release them after treatment. In looking at why hospitals did not have the capacity to always meet the demand for inpatient beds from emergency patients, hospital officials, researchers and others pointed to (1) financial pressures leading to limited hospital capacity to meet periodic spikes in demand for inpatient beds and (2) competition between admissions from the emergency department and scheduled admissions such as surgery patients, who are generally considered to be more profitable (p. 22).

It should be noted here that the issue concerning competition between ED and non-ED admissions, and the profitability of ED admissions, will be discussed in greater detail in the section below entitled *The Cost of Boarding.* It is also important to point out that the survey results from the GAO (2003) were based on responses from hospital administrators, and have not been substantiated by a quantitative analysis of U.S. ED visit data capable of producing national estimates.

In contrast to the studies associating ED boarding with crowding, Lambe et al. (2003) found an association between the number of patients waiting for inpatient beds and *shorter* waiting times (with waiting times defined as time from arrival in the ED to time of first contact with a physician). The researchers, seemingly surprised by this finding, offered several possible explanations, with the most plausible being that EDs with more patients waiting for inpatient beds may be well managed to efficiently see patients in hallways, thereby decreasing the time of first contact with a physician (Lambe et al., 2003). While this finding certainly warrants further investigation, the sheer volume of research in support of ED boarding being a significant antecedent of EDC is compelling.

While the studies reviewed above have concerned only boarded patients awaiting inpatient admission, other studies have focused specifically on the population of boarded MHSA patients, either as admitted patients or transfer patients. This population is important to study because MHSA patients make up a significant proportion of overall ED visits and hospital admissions from the ED. In a study recently published by the AHRQ, researchers found that one out of every eight visits to a U.S. ED in 2007 involved a MHSA condition, with 41 percent of those visits resulting in hospitalization, an admission rate two and a half times greater than for non-MHSA related ED visits (Owens, Mutter et al., 2010). As a comparison, Hazlett et al. (2004) found that in 2000, one out of every 18 visits to a U.S. ED involved a MHSA condition, with 22 percent of those visits resulting in hospitalization. Thus, between 2000 and 2007, researchers have demonstrated a more than doubling in the rate of MHSA related ED visits, and a nearly doubling in the rate of admission from the ED for MHSA conditions.

For another perspective, a qualitative study on ED MHSA patient boarding was conducted for the U.S. Department of Health and Human Services. In the study, the Lewin Group (2009) identified a sample of nine U.S. hospitals according to: geographic location, urban/rural status, bed size, public/private status, presence of a psychiatric ward, and state rank as a leader/laggard in mental health care. In their analysis of the extent of the problem presented by MHSA patient boarding, the researchers stated, “The majority of respondents interviewed agreed boarding was a significant problem in their hospitals. ED Directors/ED Physicians tended to perceive boarding as a more serious problem than other types of clinical staff, for example psychiatrists” (Lewin Group, 2009, p. 4).

When summarizing the main reasons cited for MHSA patient boarding, the authors listed the following: (1) lack of inpatient hospital capacity (specifically inpatient psychiatric beds); (2) liability (physicians/psychiatrists would rather admit a patient than have them harm themselves/others after being discharged); (3) insurance status or delays in pre-authorization; (4) placement or transfer issues (especially for the uninsured or patients perceived as difficult); (5) insufficient or lack of outpatient/community resources; (6) insufficient staffing (especially psychiatrists and psychiatric nurses); (7) necessity of medical clearance prior to psychiatric evaluation; and (8) compliance with EMTALA, which requires hospitals to stabilize patients prior to transfer to a psychiatric facility (Lewin Group, 2009). While the study describes the reasons for the practice of MHSA patient boarding and characterizes it as a problem, it does not establish any association between MHSA boarding and EDC measures, nor does it quantify the magnitude of the practice. In fact, as previously stated, to this researcher’s knowledge no study has determined the extent to which U.S. EDs board MHSA patients on a national level, representing a gap in the literature concerning EDC. In a review of literature conducted by the Lewin Group (2008) in connection with the 2009 study that was just described, the authors concur with this finding, stating, “To date, no comprehensive, nationwide academic evaluation of psychiatric boarding detailing the extent of the problem exists” (p. 21).

In order to learn about MHSA patient boarding practices in the U.S., the American College of Emergency Physicians (ACEP, 2008) conducted a survey of 328 U.S. ED directors. Results of the survey were as follows: (1) 79% indicated they boarded MHSA patients in their ED, with more than 90% indicating boarding every week, and more than 55% indicating boarding daily or multiple times per week; (2) over 60% of boarded MHSA patients stay in the ED over four hours after the decision to admit has been made, with 33% boarded for over eight hours and 6% boarded for over 24 hours; (3) 62% indicated no psychiatric services are provided to MHSA patients while boarded in their ED awaiting admission or transfer; (4) 89% indicated transferring MHSA patients every week due to unavailability of psychiatric beds at their hospital; (5) 23% indicated there are no community psychiatric resources available; (6) 72% indicated that MHSA ED patients require more nursing and other resources than non-MHSA patients; and (7) 85% indicated wait times for all ED patients would be reduced if they had better psychiatric services available (ACEP, 2008). In addition, in a similar survey conducted by ACEP in 2004, emergency physicians indicated that MHSA patients board twice as long as medical patients (ACEP, 2008).

In summary, the studies reviewed above suggest that the output component is an important antecedent of EDC. Regarding the input component, while little is known about the association between the safety net care population and measures of EDC, studies have shown that walk-in patients are not significantly associated with EDC, suggesting that the safety net care population seeking unscheduled urgent care may not be a significant factor in EDC (Fatovich et al., 2005; Oktay et al., 2003; Schull, Lazier et al., 2003). Future studies are needed to better understand this population's impact on EDC. Researchers studying the throughput component of EDC have demonstrated mixed results concerning the association between measures of EDC and measures of human resources, efficiency, and ED design (Kelen et al., 2001; Lambe et al., 2003; Schull, Lazier et al., 2003). Again, further research could help clarify these relationships. However, researchers studying the output component of EDC have consistently demonstrated associations between measures of EDC and the practice of boarding patients. The majority of these studies have specifically concerned boarded admitted patients (Bullard et al., 2009; Fatovich & Hirsch, 2003; Fatovich et al., 2005; GAO, 2003; IHI, 2003; Lewin Group, 2002; Lucas, Farley, Twanmoh, Urumov, Olsen et al., 2009; Schull, Lazier et al., 2003); however, no study has described the extent of the practice of boarding admitted patients in U.S. EDs on a national level. Other studies have suggested that the study of boarded MHSA patients (admitted/transfer), may impact EDC (ACEP, 2008; Lewin Group, 2008; Lewin Group, 2009; McGee & Kaplan, 2007; Pedroja, 2008). An understanding of the extent of the practice of boarding of admitted patients, as well as boarding of MHSA patients, on a national level, is a demonstrated gap in the literature (Lewin Group, 2008).

The Cost of Boarding

As stated above, the GAO (2003) found the most commonly cited reasons for inpatient boarding in the ED to be (1) financial pressures leading to limited hospital capacity, and (2) competition between the ED and scheduled admissions such as surgery patients, who are generally considered to be more profitable. However, several studies have demonstrated that ED admissions might actually be more profitable than other admissions. In a study of 62,588 ED visits during the 2005 fiscal year at a large, nonprofit, community teaching hospital in south central Pennsylvania, Falvo et al. (2007) found that providing emergency services to patients in ED beds that were instead used to board admitted patients could have resulted in $3,960,264 in additional hospital revenue.

In a similar study at a large, urban, university teaching hospital in Pennsylvania, Bayley et al. (2005) analyzed the revenue lost by the ED, which they termed the "opportunity cost," as a result of boarding admitted chest pain patients. The authors determined the annual lost revenue was $204 per patient boarding greater than three hours, or a total of $168,300 in annual opportunity cost. Another recent study took a different angle, looking at the opportunity cost of not being able to evaluate as many patients in a day, which they termed "opportunity loss" (Lucas, Farley, Twanmoh, Urumov, Evans et al., 2009). In the study, the authors examined a prospective convenience sample of 27,325 patients presenting to a cohort of five hospitals during the second week of every month for five consecutive months, with the cohort comprised of a mix of academic, community, trauma, and nontrauma centers. In the end, they found that for every 30 minutes of boarding time, hospitals lost the ability to see 3.5% of the ED's daily census, or an opportunity loss of 36 patients per day for the busiest hospital in the study. Yet another study found that admissions from the ED were more profitable for the hospital than non-ED admissions (Henneman et al., 2009). In their retrospective comparison of contribution margin (revenue minus costs) per patient over three fiscal years at an academic, urban, trauma, tertiary care hospital, the authors determined the median contribution margin per day for ED admissions was $769 whereas for non-ED admissions it was $595.

Conclusions

Leading researchers have declared EDC to be one of the most significant problems faced by EDs around the world (Fatovich, 2002; Gilligan et al., 2008; Institute of Medicine, 2006). This review of the literature has examined research demonstrating some of the negative sequelae of EDC, and focused on the antecedents of EDC through the components of input, throughput and output. While all three of these components may have a significant impact on EDC, the antecedent most consistently associated with measures of EDC is the output component, and specifically, the practice of boarding admitted patients in the ED. Despite this conclusion, a glaring limitation to the existing literature is knowledge about the extent of ED boarding practices on a national level in the U.S. As to the reasons for boarding, it has been suggested that this practice is a result of financial pressures on hospitals, with ED patients being boarded because they are considered less profitable than other types of admissions (GAO, 2003); however, studies have demonstrated lost hospital revenue from this practice, and indicated that patients admitted from the ED may actually be more profitable than other types of admissions (Bayley et al., 2005; Falvo et al., 2007; Henneman et al., 2009; Lucas, Farley, Twanmoh, Urumov, Evans et al., 2009). Unfortunately, examining the reasons hospitals practice ED boarding falls outside of the scope of this dissertation, but future studies are needed to better understand why this practice occurs. Finally, one specific population of ED boarded patients, MHSA patients, remains understudied. Researchers have determined that the MHSA patient population accounts for a considerable proportion of all U.S. ED visits, with an admission rate that is much greater than for the non-MHSA patient population (Hazlett et al., 2004; Owens, Mutter et al., 2010). Research describing the extent of the practice of boarding MHSA patients is needed in order to better understand the impact this practice may have on EDC.

Chapter Three: Methodology

In designing this research study, several assumptions were made about the nature of Emergency Department Crowding (EDC) and the practice of boarding patients. First, it is generally accepted that EDC contributes to increased morbidity and mortality of ED patients, that the practice of boarding patients in the ED contributes to EDC, and that the practice of boarding ED patients results in worse outcomes for those patients. It is also assumed that the use of EDs for patient boarding is an inefficient and poorly designed solution for an existing hospital problem. Lastly, it is generally accepted that legislative and policy changes have the ability to decrease ED patient boarding and decrease EDC.

With these assumptions in mind, this study aims to describe the extent to which the practice of boarding ED patients occurs in the U.S.; while boarding practices have been described in single- and multi-center studies, no study has been published that characterized the extent of boarding practices on a national level in the U.S. This study divided the population of boarded patients into two groups—mental health/substance abuse (MHSA) patients and non-MHSA patients—because past research has demonstrated noteworthy differences in boarding practices, resource burdens, length of boarding, and the legislation concerning these two patient populations (ACEP, 2008; Lewin Group, 2008; Lewin Group, 2009; McGee & Kaplan, 2007; Pedroja, 2008). As this study is concerned with boarding practices, it will focus on the output phase of EDC, and will examine four main concepts in its description of U.S. ED boarding practices: (1) visit characteristics, (2) patient characteristics, (3) hospital characteristics, and (4) patient's community characteristics. These concepts, and their respective measures, are discussed in greater detail below.

Purpose and Aims

The purpose of this study is to better understand U.S. ED boarding practices. To meet this purpose, this study has three aims: (1) to determine the extent to which the practice of ED boarding of MHSA patients, as admitted patients and transfer patients, occurs in the U.S.; (2) to determine the extent to which the practice of ED boarding of non-MHSA patients, as admitted patients and transfer patients, occurs in the U.S.; and (3) to describe how patient, hospital and community characteristics relate with ED boarding.

Research Questions

To address the study aims, this study will answer the following research questions:

1. What is the proportion of U.S. EDs that board patients?
2. What is the total proportion of visits to U.S. EDs that result in patient boarding, and does this proportion vary by patient type, or by hospital, patient and community characteristics?
3. For those patients who board in U.S. EDs, how long does the average patient board, and does this time vary by patient type, or by hospital, patient and community characteristics?
4. What is the total amount of ED boarding time in the U.S. annually?
5. What are the relationships among patient, hospital, and community characteristics and ED boarding?

Research Design

As with any research study, the methodology used for this study was driven by the research questions and the data source. The data source for this study is the 2008

NHAMCS, currently the only existing dataset that captures the variables necessary for this study and that is capable of producing national estimates (Owens, Barret et al., 2010). The 2008 NHAMCS is a national probability sample survey of visits to hospital outpatient and emergency departments, conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention (CDC), and allows for the application of weights to produce unbiased national estimates. The data collection survey tool for the 2008 NHAMCS, the Emergency Department Patient Record Form, appears in Appendix F.

Population/Sample

As this study aims to gain understanding about overall U.S. ED boarding practices, the population of interest in this study is the entire population of patients who visited U.S. EDs in 2008. Within this population, specific interest is placed on boarded patients, both MHSA and non-MHSA, as boarded admitted patients, boarded transfer patients, and boarded admitted/transfer patients who were ultimately discharged directly from the ED. As described in more detail below, the NHAMCS allows for the reliable approximation of the entire population of U.S. ED visits for any given year through its complex sampling algorithm and the application of weights. The NHAMCS is a national probability sample of visits to the EDs of noninstitutional general and short-stay hospitals, excluding Federal, military and Veterans Administration hospitals, from all 50 states and the District of Columbia. The dataset provides estimates in the following priority: U.S., region, ED, and type of ownership. The NHAMCS employs a four-stage probability algorithm, with samples of primary sampling units, hospitals within primary sampling units, emergency service areas within EDs, and patient visits within emergency service areas (CDC, 2008).

Primary Sampling Units

A primary sampling unit is defined as "A county, a group of counties, county equivalents (such as parishes and independent cities), towns, townships, minor civil divisions (for some primary sampling units in New England), or a metropolitan statistical area (MSA)" (CDC, 2008, p. 6). The MSAs used in the NHAMCS were originally defined by the U.S. Office of Management and Budget using the 1980 Census. The 112 primary sampling units used in the 2008 NHAMCS are comprised of the following: (1) the 26 primary sampling units with the largest populations from the 1985-94 National Health Interview Survey (NHIS), (2) one-half of the next 26 largest primary sampling units from the NHIS, and (3) one primary sampling unit from each of the 73 primary sampling unit strata formed from the remaining primary sampling units for the NHIS sample.

Additionally, the CDC (2008) states that the original NHIS sample of primary sampling units was drawn from a population of 1,900 geographically defined primary sampling units from the 50 States and the District of Columbia. Prior to drawing the sample, these 1,900 units were stratified by demographic and socioeconomic variables (within four geographic regions by MSA or non-MSA status), then selected with a probability proportional to their size.

Hospitals

Hospitals for the 2008 NHAMCS were defined as those that were designated as general or children's general and had an average length of stay for all patients of less than

30 days. Hospitals were excluded if they were Federal hospitals, hospital units of institutions, or hospitals with less than six beds. According to the CDC (2008), all hospitals in non-certainty primary sampling units with five or fewer hospitals were selected with certainty (149 hospitals in 55 primary sampling units in this category). For those non-certainty primary sampling units with more than five hospitals, hospitals were stratified by hospital class, type of ownership, and size (size measured by combined volume of ED and outpatient department visits). From this stratified hospital list, five hospitals were selected from each primary sampling unit based on probability proportional to size (161 hospitals in this category). In the certainty primary sampling units, hospitals were stratified by region, hospital class, ownership, and size, and then 240 hospitals were selected based on probability proportional to size. Finally, from the 427 hospitals that had neither an ED nor an outpatient department, a sample of 50 hospitals was selected (CDC, 2008). Of the resulting sample of 475 hospitals, 79 were found to be ineligible (due to closing or other reasons), and 357 of the eligible hospitals chose to participate in the survey. This amounted to an unweighted hospital sampling response rate of 90.2 percent (89.8 percent weighted).

Emergency Service Areas

The CDC compiles two separate databases each year as part of the NHAMCS: (1) the ED data file, and (2) the Outpatient Department (OPD) file. While the OPD file is not relevant to this study, it is important to note that the CDC uses the same algorithm to select its sample for both the ED file and the OPD file. Up to and including the hospital stage, both samples are identical; however, at the emergency service area stage the samples diverge. This divergence is based on whether an OPD meets the criteria for definition as an ED versus an outpatient clinic. The CDC (2008) clearly defined its criteria for determining whether an ED (or an emergency service area) was selected for inclusion in the ED file or the OPD file for the 2008 NHAMCS. If an ED was staffed 24 hours per day, it was considered in-scope and therefore included in the ED file; if an in-scope ED had an emergency service area that was open for less than 24 hours per day, the emergency service area was included with the ED. If a hospital had an ED staffed less than 24 hours per day then it was considered an OPD. Each ED was treated as a separate stratum, and all emergency service areas were selected with certainty. Of the hospitals eligible for the study, 353 had EDs and chose to participate in the survey, resulting in an unweighted ED response rate of 93.1 percent. From these 353 EDs, a total of 463 emergency service areas were selected, and of these, 431 responded fully, leading to a total of 34,134 patient visit records for the survey (CDC, 2008).

Patient Visits

The sampling unit for the NHAMCS is the patient visit. This is defined as a direct, personal exchange between a patient and a physician, or a staff member acting under a physician's direction, for the purpose of seeking care and rendering health services, in the U.S., to EDs of non-Federal, short-stay, or general hospitals. For the 2008 NHAMCS, visits were systematically selected over a randomly assigned 4-week reporting period, with a target number of 100 visit records for each hospital, totaling 34,134 visit records for the entire survey.

Definitions of Variables and Terms

The 2008 NHAMCS contains 386 variables describing hospital, ED and visit characteristics. However, only a fraction of these variables were used in this study. Table

3 lists the variables that were used, grouped into four concepts corresponding to: (1) visit characteristics, (2) hospital characteristics, (3) patient characteristics, and (4) patient's community characteristics. Each variable will be discussed below with respect to its conceptual definition, as well as its operational definition in the 2008 NHAMCS.

Table 3. *Conceptual definitions of variables to be used in the study*

Variable Name	Conceptual Definition
	1. Visit Characteristics
Boarded patient	A patient whose ED evaluation is complete and the decision has been made to admit to the hospital or transfer to another facility, but there is no available bed and the patient remains in the ED. This includes patients who never secure a bed in the hospital or a transfer facility, and are ultimately discharged from the ED.
Patient boarding time	The time from decision to admit or transfer until departure from the ED.
	2. Hospital Characteristics
Hospital geographic region	The region of the U.S. in which the ED is located (Northeast, Midwest, South, or West).
Hospital metropolitan status	Whether the ED is located in a metropolitan or a non-metropolitan area.
Hospital ownership	The type of ownership of the hospital in which the ED is located (Voluntary non-profit, Government non-Federal, or Proprietary).
Hospital elective surgery schedule	The number of days per week the hospital schedules elective surgeries.
Hospital ambulance diversion time	The time in minutes or hours a hospital spends per day/week/year diverting ambulances to alternate hospitals.
Safety net status	A hospital serving >30% Medicaid patients, >30% uninsured patients, or >40% combined Medicaid and uninsured patients.
Boarding ED	An ED that routinely practices ED boarding.
	3. Patient Characteristics
Mental health/substance abuse (MHSA) patient	A patient whose ED visit is related to a MHSA condition.
Patient age	The patient's age.
Patient residence	The patient's current place of residence (Private Residence, Nursing Home, Other Institution, Other Residence, Homeless, or Unknown).
Patient sex	The patient's sex (Male or Female).
Patient race	The patient's race (White, Black/African American, Asian, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, Multiple Races Reported, or Unknown).
Patient ethnicity	The patient's ethnicity (Hispanic/Latino, not Hispanic/Latino, or Unknown).

Patient expected source of payment	The expected primary source of payment for the visit (Private Insurance, Medicare, Medicaid/SCHIP, Worker's Compensation, Self-Pay, No Charge/Charity, Other, or Unknown).
Patient frequency of ED use	The number of previous times the patient has been seen in the ED associated with the visit record in the last 12 months.
Patient diagnosis	The patient's diagnosis (ICD-9-CM).
Patient cause of injury, poisoning, or adverse event	The specific details regarding the cause of the injury, poisoning, or adverse event relating to the patient's visit (ICD-9-CM).
	4. Patient's Community Characteristics
Community poverty	Percent of poverty in patient's community.
Community income	Median household income in patient's community.
Community education	Percentage of adults with a Bachelor's Degree or higher in patient's community.
Community urban/rural status	Urban-rural classification of the patient's community.

Visit Characteristics

To address the posed research questions, the most important variables to measure are characteristics particular to the visit: whether the patient was boarded, and if so, the amount of time spent boarding. Unfortunately, the U.S. currently lacks a standard definition for boarding (Lewin Group, 2009). Ideally, the concept of boarding describes ED patients whose evaluation is complete and for whom the decision has been made to either admit or transfer, but there is no available bed. However, capturing the exact moment when this decision to admit or transfer occurs is difficult, as EDs have differing practices, administrative systems, and charting processes. As a result, boarding and boarding time have been defined using several different measures in the literature. In Australia, the term access block is used in lieu of boarding. The Australian practice standard definition for access block is when a patient has been awaiting admission or transfer with a total time in the ED of greater than eight hours (Australian College for Emergency Medicine, 2002). In the United Kingdom, the policy of the National Health

Service (NHS) is that no ED patient should wait longer than four hours from arrival to admission, transfer or discharge (NHS, 2000). While the NHS does not explicitly use the terms boarding or access block to define a wait of greater than four hours, it seems reasonable to assume greater than four hours as a benchmark for boarding given the wording of the policy. In the U.S., researchers have used such definitions for boarding time as time from bed request to departure from the ED (Pines et al., 2008), and time from decision to admit until actual arrival in the admitting unit (Chalfin et al., 2007).

Additionally, in one U.S. study using 2003-2005 NHAMCS data where neither time of decision to admit nor time of bed request were captured in the dataset, researchers used ED length of stay (the difference between ED arrival and ED departure) as a proxy for boarding time, with six hours chosen as a “reasonable time frame” for ED length of stay (Pines, Localio et al., 2009, p. 404). While the 2008 NHAMCS does not contain information regarding time of decision to admit (or transfer) or time of bed request (or transfer request), it does contain data regarding ED length of stay, so it would be possible to follow the example of Pines, Localio et al. (2009) to construct a proxy for boarding time. Therefore, to address the research questions above, boarded patients will be operationally defined as patients for whom the 2008 NHAMCS visit record indicates a visit disposition of admit to hospital, or transfer to a different hospital, and an ED length of stay of greater than six hours. Patient boarding time will be operationally defined as the total ED length of stay minus six hours. Furthermore, in order to account for those boarded patients who never secure a bed in an admitting unit or transfer facility, and are subsequently discharged directly from the ED, the operational definition of a boarded patient will also include patients for whom the 2008 NHAMCS visit record indicates a visit disposition of ED discharge, and an ED length of stay greater than six hours. Table 4 summarizes the operational definitions of visit characteristics to be used in this study:

Table 4. *Operational definitions for visit characteristics*

Variable Name	Operational Definition
Boarded patient	1 = admitted patient with ED LOS >6 hours 2 = transferred patient with ED LOS >6 hours 3 = discharged patient with ED LOS >6 hours
Patient boarding time	Total ED LOS minus 6 hours

Hospital Characteristics

In order to describe the relationship between hospital characteristics and visit characteristics, the following hospital-specific variables are of interest in this study: geographic region, metropolitan status, ownership, elective surgery schedule, hospital ambulance diversion time, and safety net status. Geographic region, metropolitan status, ownership, and safety net status are important demographic variables that have the potential to illustrate differences in visit characteristics among subgroups. Hospital metropolitan status is determined according to the 2008 NHAMCS variable for metropolitan statistical area. Within the dataset, this variable is defined as whether the hospital is located in a statistical area determined by the U.S. Office of Management and Budget (derived from U.S. Census Bureau data) as having at least one urbanized area with a population of 50,000 or more, including any socially and economically integrated adjacent territory, without regard to state borders (CDC, 2008; U.S. Office of Management and Budget, 2007). Elective surgery schedule is a variable that may be useful in identifying relationships between visit characteristics and the practice of hospital rationing of inpatient beds to elective surgery patients, as it has been suggested that such rationing contributes to EDC (GAO, 2003; Henneman et al., 2009). Likewise, ambulance diversion time is an important variable to examine with relation to visit characteristics because several studies have demonstrated a significant association between the number of admitted patients boarding in the ED and ambulance diversion measures (Fatovich et al., 2005; Schull, Lazier et al., 2003). It is recognized that ambulance diversion networks are managed differently throughout geographic regions in the U.S., with some regions eschewing the practice altogether (Patel et al., 2006; Vilke et al., 2004); however, as a measure of ambulance diversion is captured by the NHAMCS, it seems worthwhile to analyze its relationship with boarding, given the significance attributed to this variable by previous studies and the depth and breadth of the available dataset.

To address research question one, a variable for whether an ED was a “boarding ED” had to be constructed. While a boarding ED is conceptually defined as an ED that routinely practices patient boarding, a more concrete operational definition was required for the analysis. As it did not seem appropriate to define a boarding ED as an ED in the dataset for which at least one visit resulted in patient boarding, the dataset was analyzed to determine whether there were any characteristics inherent to the frequency distribution of boarded patients that would make a more reasonable cutoff. In the naïve dataset, a natural break occurred: exactly 25.0% of the EDs in the naïve dataset had greater than 4.0% of visits that resulted in patient boarding. A boarding ED was therefore defined as an ED for which >4% of all visits sampled resulted in ED stays of >6 hours. To help illustrate this point, Figure 1 below shows the frequency distribution of boarding visits per ED in the unweighted dataset, with a reference line at the 25th percentile for the sample (4% of visits). Table 5 summarizes the operational definitions of hospital characteristics to be used in this study:

Figure 1. *Frequency Distribution of Boarding Visits Per ED in the Unweighted Sample (Reference Line at 25th Percentile of Sample)*

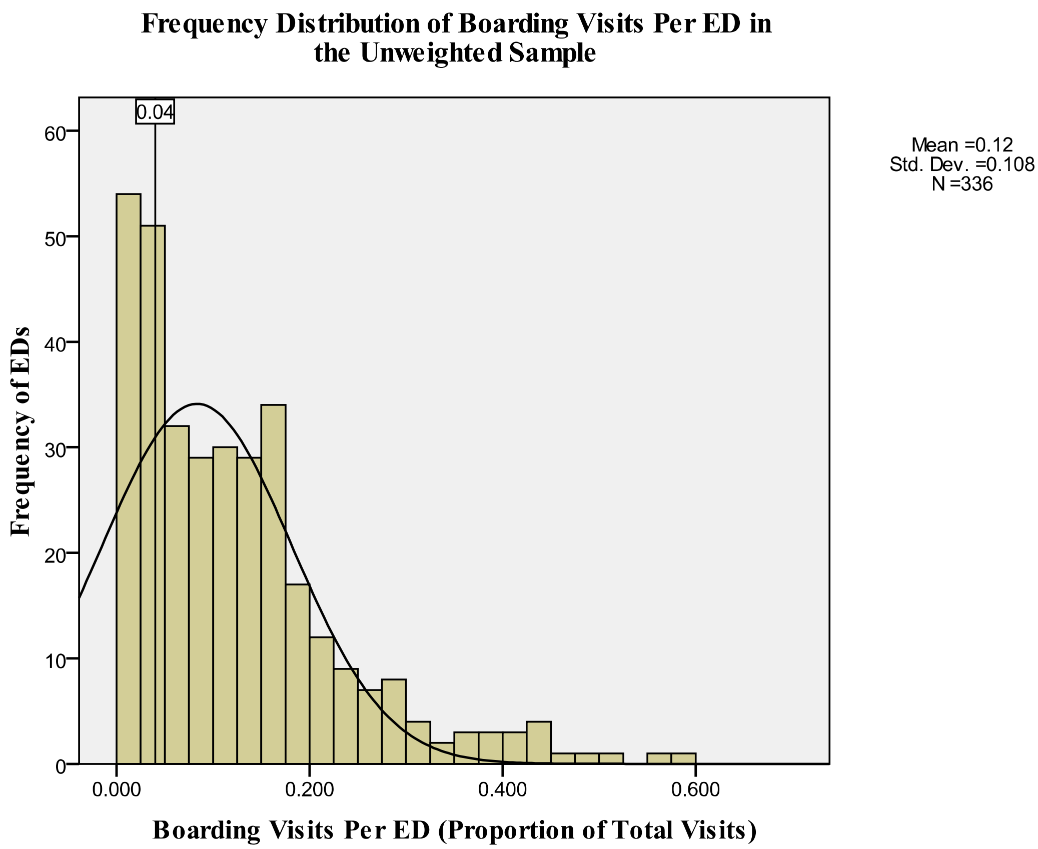


Table 5. *Operational definitions for hospital characteristics*

Variable Name	Operational Definition
Hospital geographic region	1 = Northeast (CT, ME, MA, NH, NJ, NY, PA, RI, VT) 2 = Midwest (IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI 3 = South (AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV) 4 = West (AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY)
Hospital metropolitan status	1 = located in a Metropolitan Statistical Area 2 = not located in a Metropolitan Statistical Area
Hospital ownership	1 = Voluntary non-profit 2 = Government non-federal 3 = Proprietary

Hospital elective surgery schedule	1 = None 2 = One day/week 3 = Two days/week 4 = Three days/week 5 = Four days/week 6 = Five days/week 7 = Six days/week 8 = Seven days/week
Hospital ambulance diversion time (aggregated number of hours the hospital was on ambulance diversion in 2007)	1 = 0 2 = 1-99 3 = 100-499 4 = 500 or more
Safety net status	A hospital serving >30% Medicaid patients, >30% uninsured patients, or >40% combined Medicaid and uninsured patients.
Boarding ED	An ED for which >4% of all visits sampled resulted in ED stays of >6 hours.

Patient Characteristics

In order to describe the relationship between patient characteristics and visit characteristics, the following patient-specific variables are of interest in this study: MHSA status, age, residence, sex, race, ethnicity, expected source of payment, and frequency of ED use. A visit was determined to be related to a MHSA condition (and therefore coded as a MHSA patient) by screening the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code for the patient's (1) diagnosis, and (2) cause of injury, poisoning or adverse event, to identify codes that match known MHSA codes using AHRQ's Healthcare Cost and Utilization Project Clinical Classification Software (CCS) for ICD-9-CM codes.

ICD-9-CM codes and CCS.

ARHQ developed the CCS as a tool for grouping patient diagnoses and procedures into clinically meaningful categories, with the aim of simplifying the process of analyzing ICD-9-CM codes when conducting research (Elixhauser, Steiner & Palmer, 2010). In 2008, AHRQ went a step further, developing a special tool for MHSA conditions. According to AHRQ, the MHSA CCS tool was developed using the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994), in consultation with staff at both the National Institutes for Mental Health and the Substance Abuse and Mental Health Services Administration, among other experts (Elixhauser, Steiner & Palmer, 2010). The resulting tool provides an ideal set of ICD-9-CM codes relating to MHSA conditions for use in this study. The ICD-9-CM codes included in the MHSA CCS tool, grouped by CCS category, appear in Appendix G (Elixhauser, Steiner & Palmer, 2010).

Following the findings of Owens, Mutter et al. (2010) based on the Nationwide Emergency Department Sample (a national probability sample from 2007), it was anticipated that the screening above would result in approximately 12.5% of all visits in the 2008 NHAMCS being identified as MHSA related. However, after the screening and coding, preliminary analyses revealed only 6.4% of the sample had been identified as MHSA related. With such a large discrepancy, the dataset was further screened for MHSA related visits that might not have been identified based on the CCS tool's ICD-9-CM codes listed in the patient's diagnosis or the cause of injury. Cases were flagged for further review and consideration for coding as MHSA related based on the following additional screening criteria: (1) the visit resulted in admission to a mental health or detox unit; (2) a toxicology screen was sent during the visit; (3) the reason for the visit was listed as intentional injury; (4) the visit resulted in transfer to another facility for psychiatric, mental health or substance abuse care; and (5) the visit included a diagnosis or cause of injury not included in the CCS tool but that might indicate a MHSA related visit, e.g. “983: hanging, strangulation or suffocation” (see Appendix H for list of codes). These additional screening criteria led to the flagging of 1223 cases for further review; however, after evaluating each case individually for unequivocal inclusion as a MHSA related visit, only 63 additional cases were coded as MHSA related (an increase of 0.19% of MHSA patients to the weighted sample). Table 6 summarizes the operational definitions of patient characteristics to be used in this study:

Table 6. *Operational definitions for patient characteristics*

Variable Name	Operational Definition
Mental health/substance abuse (MHSA) patient	A patient whose visit record indicates an ICD-9-CM code for either (1) diagnosis or (2) cause of injury, poisoning or adverse event that is included in AHRQ’s MHSA Clinical Classification Software (Appendix G).
Patient age	Age (years)
Patient residence	1 = Private residence 2 = Nursing home 3 = Other institution 4 = Other residence 5 = Homeless
Patient sex	1 = Male 2 = Female
Patient race	1 = White 2 = Black/African American 3 = Asian 4 = Native Hawaiian/Other Pacific Islander 5 = American Indian/Alaska Native 6 = Multiple Races
Patient ethnicity	1 = Hispanic/Latino 2 = Not Hispanic/Latino
Patient expected source of payment	1 = Private insurance 2 = Medicare 3 = Medicaid/SCHIP 4 = Worker’s Compensation 5 = Self-pay 6 = No charge/charity 7 = Other
Patient frequency of ED use	The number of previous times the patient has been seen in the ED associated with the visit record in the last 12 months.
Patient diagnosis	The patient’s diagnosis (ICD-9-CM).

Patient cause of injury, poisoning, or adverse event	The specific details regarding the cause of the injury, poisoning, or adverse event relating to the patient's visit (ICD-9-CM).

Patient's Community Characteristics

In order to describe the relationship between patient's community characteristics and visit characteristics, the following community-specific variables are of interest in this study: poverty, income, education, and urban/rural status. The 2008 NHAMCS provides data for these variables linked to patients according to the ZIP code of the patient's residence as indicated on the visit record. Unfortunately, the documentation provided with the 2008 NHAMCS does not specify the original source of this data. As all other population figures for the 2008 NHAMCS come from U.S. Census Bureau data, it seems reasonable to assume that the U.S. Census Bureau is also the source for these data. These variables are operationally defined in the 2008 NHAMCS as follows:

Table 7. *Operational definitions for patient's community characteristics*

Variable Name	Operational Definition
Community poverty	1 = Less than 5.00% 2 = 5.00-9.99% 3 = 10.00-19.99% 4 = 20.00% or more
Community income	1 = $32,793 or less 2 = $32,794-$40,626 3 = $40,627-$52,387 4 = $52,388 or more
Community education	1 = Less than 12.84% 2 = 12.84%-19.66% 3 = 19.67%-31.68% 4 = 31.69% or more
Community urban/rural status	1 = Large central metro 2 = Large fringe metro 3 = Medium metro 4 = Small metro 5 = Non-metro (micropolitan and non-core)

Data Collection Procedures

The 2008 NHAMCS sample was compiled using results of survey visits to U.S. EDs based on the sampling algorithm previously described. The U.S. Bureau of the Census was responsible for the data collection, and field representatives received two days of classroom training and four hours of self-study prior to hospital visits. Field representatives then instructed hospital staff about the data collection process and procedures for completing the visit records for the survey. Hospital staff were utilized for visit sampling, rather than field representatives, for the following three reasons: (1) unique hospital record keeping practices made it difficult for field representatives to perform this role, (2) many hospitals did not want to give field representatives access to confidential information, and (3) hospital staff could collect the data at or near the actual visit times leading to more accurate data. Hospitals were contacted about the survey three months before the data collection period in order to prepare for the survey and gain Institutional Review Board approval.

Field representatives visited sites each week during the data collection period, and maintained telephone contact with hospital staff in order to ensure quality control during the data collection process. Furthermore, the patient visit survey records were reviewed by field representatives for missing data, and attempts were made to complete missing data by consulting hospital staff or through review of medical records. To ensure confidentiality, the top section of each survey record, containing the patient's name and record number (see Appendix F), was detached prior to submission to the field representative. Hospital staff were advised to retain this section for four weeks in the event that the survey record required review for clarification or retrieval of missing data.

Following data processing, all medical and drug coding/keying operations were subject to a two-way 10 percent independent verification procedure. Additionally, all survey records with differences between coders or with illegible entries for reason for visit, diagnostic and therapeutic procedures, diagnosis, cause of injury, and medication items were reviewed and adjudicated (CDC, 2008). The average keying error rate for non-medical items was 0.8 percent, while medical coding had discrepancy rates ranging between 0.7 and 1.4 percent.

Data Considerations

Missing Data

The CDC (2008) reports that unweighted item nonresponse rates were 5.0% or less for all but the following variables to be used in this study: race (15.3%), ethnicity (23.8%), primary expected source of payment of visit (6.1%), how many times has patient been seen in this ED within the last 12 months (41.6%), cause of injury (17.0% of injury-related visits), type of unit to which patient was admitted (13.0% of admission-related visits), and how many days per week are elective surgeries scheduled (11.7%). Also, ZIP codes that were missing or invalid led to nonresponse rates for the following variables of interest in this study: median household income in patient’s ZIP code (6.1%), percent of adults with a Bachelor’s Degree or higher in patient’s ZIP code (6.1%), and percent of poverty in patient’s ZIP code (6.1%). Missing data for two of the above items, race and ethnicity, were imputed using the following algorithm: (1) a hot deck approach using current year data from a matching record based on diagnosis and patient’s ZIP code/county of residence; (2) a cold deck approach using data from previous year(s); (3) diagnosis, hospital, emergency service area, and immediacy with which the patient should be seen; and (4) failing all other methods, data was imputed from a randomly selected record. For all analyses in this study, missing data was handled by listwise deletion.

Estimation Procedures

The NHAMCS produces unbiased national probability estimates through the use of a multistage estimation procedure having three components: (1) inflation by reciprocals of the sampling selection probabilities, (2) adjustment for nonresponse, and (3) a population weighting ratio adjustment. Each of these components is described in the documentation for the 2008 NHAMCS (CDC, 2008), which is summarized below.

Inflation by reciprocals of selection probabilities. Each stage of sampling has one probability of being selected, and the product of these four probabilities is the overall probability of selection. The basic inflation weight is the inverse of this overall probability of selection.

Adjustment for nonresponse. Two types of nonresponse exist: (1) data from hospitals that refused to participate, and (2) failure of an emergency service area to provide completed patient visit survey records for a sample of its patient visits. To address the first type of nonresponse, weights of visits to hospitals similar to the nonrespondent hospital were inflated to represent the missing visit data. A hospital was deemed similar to a nonrespondent hospital based on region, ownership type, and MSA status. To address the second type of nonresponse, weights of visits for emergency service areas similar to the nonrespondent emergency service areas were inflated to represent the missing visit data. An emergency service area was deemed similar to a nonrespondent emergency service area based on region, ownership type, MSA status, and emergency service area group.

Ratio adjustments. Adjustments were made within hospital strata by region and ownership type, and for all regions except the West, adjustment strata were further defined by MSA status. Adjustment factors were based on: (1) a numerator which was the sum of annual visit volumes reported to EDs in sampling frame hospitals in the stratum, and (2) a denominator which was the estimated number of those visits for that stratum.

Patient Visit Weight

In order to produce national estimates based on the 34,134 visits captured by the dataset, each record in the 2008 NHAMCS contains an inflation factor, the patient visit weight. The sum of all patient visit weights in the dataset equals the total of 123,761,309 estimated visits to U.S. EDs in 2008.

Emergency Department Weight

The 2008 NHAMCS also contains a weight to enable researchers to calculate department-level estimates. This weight, the emergency department weight, will be used in the data analysis of estimations involving hospital characteristics.

Reliability of Estimates

While the 2008 NHAMCS is capable of producing national probability estimates based on data from these 34,134 unweighted visits, users are warned to pay close attention to the reliability of the estimates. This is because a relatively small number of visits for any single variable can be used to determine that variable's national probability estimate. This is best described by the administrators of the NHAMCS when they state:

> Users should also be aware of the reliability or unreliability of certain estimates, particularly the smaller estimates. The National Center for Health Statistics considers an estimate to be reliable if it has a relative standard error of 30 percent or less (i.e., the standard error is no more than 30 percent of the estimate). Therefore, it is important to know the value of the lowest possible estimate in this survey that is considered reliable, so as not to present data in a journal article or paper that may be unreliable. Most data file users can obtain an adequate working knowledge of relative standard errors from the information presented in Appendix I. It should be noted that estimates based on fewer than 30 records are also considered unreliable, regardless of the magnitude of the relative standard error (CDC, 2008).

Thus, appropriate evaluation of relative standard errors and number of records was performed following the above guidelines for all analyses in this study.

Calculation of Estimates and Standard Errors

Calculation of population estimates and standard errors for the NHAMCS must take into account the complex nature of the sample design. Siller and Tompkins (n.d.) summarize this concern well:

> The multistage area probability designs of [surveys like the NHAMCS] include clustering, stratification, and the assignment of unequal probabilities of selection to sample units. The complexity of these sample designs causes a departure from the assumption that independent sample points have equal probabilities of selection. Specialized statistical software is required to accurately compute estimates of population statistics and their standard errors; otherwise, the standard

> errors produced, as for a simple random sample, would generally underestimate the true population value, negating the validity of resulting confidence intervals or statistical significance tests (p. 1).

Fortunately, providers of software packages commonly used for statistical analyses, such as SAS, Stata, and SPSS, have developed procedures or modules for use with such complex sample designs. The 2008 NHAMCS contains two variables for use in these computations: CSTRATM and CPSUM. Directions for using these variables, including command statements for SAS, Stata, and SPSS, are provided in the documentation for the 2008 NHAMCS and were performed as directed (CDC, 2008).

Data Analysis

The descriptive analyses for this study (research questions 1-4) were conducted using Stata/SE version 11.2 (StataCorp LP, College Station, TX); the multilevel regression analysis (research question 5) was conducted using Mplus version 6.11 (Muthén & Muthén, Los Angeles, CA). The study characterizes the population of patient visits to U.S. EDs in 2008, particularly those visits resulting in patient boarding. The visit characteristics of the population were analyzed by hospital, patient and patient's community characteristics using the following descriptive statistics as appropriate: mean, standard deviation, median, range, proportion, and frequency distribution. By applying appropriate weights provided with the 2008 NHAMCS, this analysis produced unbiased national estimates for these characteristics. Standard errors were computed as previously described, and 95% confidence intervals (CIs) are provided for all estimates. Differences in proportions of subgroups (by characteristic) were tested using a transformed chi-square test statistics, with significance assessed at $\alpha = .05$.

Research Question One: What is the proportion of U.S. EDs that board patients? In order to address this research question, the variables “boarded patient” and “boarding ED” were created in the dataset as previously described (see Table 4). Appropriate descriptive statistics were then analyzed, applying weights to the dataset as required to determine the proportion of U.S. EDs that boarded patients. Included in these descriptive statistics is a breakdown by subgroups of hospital characteristics (see Table 5) in order to better understand differences within the sample. Differences were tested using a transformed chi-square test statistics, with significance assessed at $\alpha = .05$.

Research Question Two: What is the total proportion of visits to U.S. EDs that result in patient boarding, and does this proportion vary by patient type, or by hospital, patient and community characteristics? Again using the new variable “boarded patient,” appropriate descriptive statistics were analyzed, applying weights as required, in order to answer the research question. This question was addressed overall, as well as separately for the subpopulations of MHSA and non-MHSA patients, as admitted patients, transfer patients, and patients ultimately discharged directly from the ED. Included in these descriptive statistics is a breakdown by subgroups of hospital, patient, and patient’s community characteristics (see Tables 5-7) in order to better understand differences within the sample. Differences were tested using a transformed chi-square test statistics, with significance assessed at $\alpha = .05$.

Research Question Three: For those patients who board in U.S. EDs, how long does the average patient board, and does this time vary by patient type, or by hospital, patient and community characteristics? Answering this research question required the addition of another new variable to the dataset, “patient boarding time,” following the criteria previously defined. Appropriate descriptive statistics were then analyzed, applying weights as required, in order to determine a total average boarding time as well as average boarding times for the subpopulations of MHSA and non-MHSA patients, as admitted patients, transfer patients, and patients ultimately discharged directly from the ED. Included in these descriptive statistics is a breakdown by subgroups of hospital, patient, and patient's community characteristics (see Tables 5-7) in order to better understand differences within the sample. Tests of significance for differences between group means (F-tests) were performed, with significance assessed using $\alpha = .05$.

Research Question Four: What is the total amount of ED boarding time in the U.S. annually? Again using the new variable "patient boarding time," appropriate descriptive statistics were analyzed, applying weights, to compute total annual ED boarding time as well as annual boarding times for the subpopulations of MHSA and non-MHSA patients, as admitted patients, transfer patients, and patients ultimately discharged directly from the ED. These times were compared to total annual ED patient visit times as a reference point for all categories.

Research Question Five: What are the relationships among patient, hospital, and community characteristics and ED boarding? To answer this research question, multilevel regression analyses were conducted using Mplus version 6.11 (Muthén & Muthén, Los Angeles, CA). In an effort to parsimoniously represent the results, rather than create separate models for MHSA and non-MHSA subpopulations, the variable MHSA was tested for interactions with all other variables. Level one variables were patient and patient's community characteristics; level two variables were hospital characteristics. First, board time was regressed on individual predictors in separate models, then a final multivariate multilevel model was created. Significance was assessed at $\alpha = .05$.

Measurement Assumptions and Data Checking

All analyses above were subjected to rigorous data checking and tests of measurement assumptions during the data analysis process. Data points that fell ±3 standard deviations (SD) from the mean were investigated to ensure against data entry or other errors. To address potential non-normality of the data or violations of the assumption of independence, estimates for the multilevel analysis were obtained in Mplus using the MLR technique, defined as "maximum likelihood parameter estimates with standard errors…that are robust to non-normality and non-independence of observations" (Muthén & Muthén, 2010, p. 533). These concerns were also largely mitigated by the large sample size inherent to the dataset. To test for multicollinearity in the multilevel analyses, predictors at level one and level two were first standardized, then regressed against all other predictors at the same level and assessed for significance according to the method described by Heeringa, West, and Berglund (2010); however, no results concerning for multicollinearity were observed following this technique. Other data checking and validation of measurement assumptions were performed as described in the sections *Reliability of Estimates* and *Calculation of Estimates and Standard Errors* above. Finally, tests for interactions between independent variables were performed, with interaction terms incorporated into the final model where significant.

Protection of Human Subjects

An application to the Committee on Human Research (CHR) at the University of California, San Francisco (UCSF) was submitted for approval prior to the commencement of this study. The study relied on analyses of secondary data from the 2008 NHAMCS, a free, public-use dataset containing no personally identifiable data. Furthermore, the 2008 NHAMCS was the sole source of data used in this study. The study therefore met the requirements for approval by means of a "Denial of Requested Review" by the CHR at UCSF, as it was deemed not to qualify as human subjects research (see Appendix I).

Chapter Four: Results

The purpose of this study was to better understand U.S. ED boarding practices. To meet this purpose, this study of U.S. ED boarding practices addresses five research questions. Results will be presented in the order of these research questions. Results are based on the analysis of the 2008 NHAMCS, currently the only existing dataset that captures the variables necessary for this study and that is capable of producing national estimates (Owens, Barret et al., 2010). The NHAMCS is a national probability sample survey of visits to hospital EDs that allows for the application of weights to produce unbiased national estimates. Unless otherwise explicitly stated, all results presented are weighted estimates.

This study aims to gain understanding about overall U.S. ED boarding practices within the entire population of patients who visited U.S. EDs in 2008. Specific interest is placed on boarded patients overall, as well as on the subpopulations of patients with mental health/substance abuse conditions (MHSA) and without mental health/substance abuse conditions (non-MHSA). Each of these three populations (overall, MHSA, and non-MHSA) of boarded patients have been analyzed by three distinct visit types: (1) boarded admitted patients, (2) boarded transfer patients, and (3) boarded admitted/transfer patients who were ultimately discharged directly from the ED.

In order to produce these national estimates, each of the unweighted 34,134 patient visit records contained in the dataset has an inflation factor, the patient visit weight. The sum of all patient visit weights in the dataset equals the total of 123,761,309 estimated visits to U.S. EDs in 2008. Of all those visits, 11% (more than 13 million) patients stayed longer than 6 hours (i.e., were boarded), and 6.5% (more than 8 million) of all visits were for MHSA related conditions. Visit boarding and MHSA characteristics for the weighted sample are presented in Table 8 below:

Table 8. *Proportion of Visits in the 2008 NHAMCS Weighted Sample by Characteristic (N=123,761,309)*

Disposition	Boarded	Not Boarded	
Proportion	11.0%	89.0%	
(N)	(13,656,488)	(110,104,821)	
Boarding Category	Admitted Boarder	Transferred Boarder	Discharged Boarder
Proportion	35.8%	3.9%	60.4%
(N)	(4,891,349)	(531,591)	(8,243,016)
MHSA Status	MHSA Related Visit	Non-MHSA Related Visit	
Proportion	6.5%	93.5%	
(N)	(8,100,308)	(115,661,001)	

The 2008 NHAMCS also contains a weight to enable researchers to calculate department-level estimates. This weight, the ED weight, was used to calculate the ED level estimates necessary to answer research questions one and five. The unweighted sample for the 2008 NHAMCS contained 336 EDs; this amounted to a weighted estimate of 4,745 EDs. Most (73.4%) of the EDs were in voluntary non-profit hospitals, and 39.7% were located in the South (see Table 5 in Chapter 3 for list of states corresponding to each region). Characteristics for the weighted sample of EDs are presented in Table 9:

Table 9. *Proportion of EDs in the 2008 NHAMCS Weighted Sample by Characteristic (N=4745)*

Region	Northeast	Midwest	South	West
Proportion	13.7%	28.5%	39.7%	18.1%
(N)	(650)	(1352)	(1882)	(861)
Metropolitan Status	MSA	Non-MSA		
Proportion	65.6%	34.4%		
(N)	(3111)	(1634)		
Ownership	Voluntary Non-Profit	Government Non-Federal	Proprietary	
Proportion	73.4%	12.7%	13.9%	
(N)	(3485)	(602)	(658)	
Safety Net Status	Safety Net	Non-Safety Net		
Proportion	43.5%	56.5%		
(N)	(2051)	(2668)		

It should also be noted here that the default test statistic reported by Stata and many other software systems in the analysis of categorical data from complex surveys is the design-adjusted Rao-Scott F-statistic (Heeringa et al., 2010). This test of significance, referred to in Stata as the “design-based Pearson,” is actually a Pearson chi-square statistic that is transformed to correct for the design effects of using weighted estimates (StataCorp, n.d.). Therefore, this statistic will be reported with all categorical results (research questions one and two).

Research Question One

What is the proportion of U.S. EDs that board patients? Table 10 below shows a breakdown of boarding EDs by proportion of EDs in each U.S. region. Of the estimated 4,745 EDs in the U.S., there were 2,743 that met the criteria as a boarding ED (>4% of all visits resulted in ED stays greater than 6 hours), corresponding to a proportion of 57.8%. The design-based Pearson F-test for differences among the regions was analyzed and found to be significant. These results demonstrate that the Midwest was the only region to have fewer boarding EDs than non-boarding EDs, with the Northeast and the West being the two regions with the highest proportion of boarding EDs.

Table 10. *Proportion of Boarding EDs by U.S. Region*

Boarding ED	U.S. Total (95% CI) (N)	Northeast (95% CI) (N)	Midwest (95% CI) (N)	South (95% CI) (N)	West (95% CI) (N)	Design-based Pearson
Yes	57.8% (47.1-68.5) (2743)	79.7% (60.5-91.0) (518)	38.8% (20.1-61.6) (525)	55.7% (39.5-70.9) (1048)	75.6% (59.6-86.7) (651)	$F_{2.5, 438.7}=3.7$ $p=0.02$
No	42.2% (31.5-52.9) (2002)	20.3%* (9.1-39.5) (132)	61.2% (38.4-79.9) (827)	44.3% (29.2-60.5) (834)	24.4% (13.3-40.4) (210)	

*Unreliable: standard error >30% of estimate

Considering other hospital characteristics that describe differences in proportions for U.S. boarding EDs, Tables 11-13 below present a breakdown of boarding EDs by metropolitan statistical area (MSA), type of hospital ownership, and whether or not the hospital was a safety net hospital. These results show a significantly greater proportion of boarding EDs were located in MSAs. There was no significant difference according to ownership or safety net status.

Table 11. *Proportion of U.S. Boarding EDs by MSA Status*

Boarding ED	MSA (95% CI) (N)	Non-MSA (95% CI) (N)	Design-based Pearson
Yes	74.0% (65.6-81.0) (2302)	26.9% (13.0-47.6) (440)	$F_{1, 175}$=18.2 p<.0001
No	26.0% (19.0-34.4) (809)	73.1% (52.4-87.0) (1194)	

Table 12. *Proportion of U.S. Boarding EDs by Type of Ownership*

Boarding ED	Voluntary Non-Profit (95% CI) (N)	Government Non-Federal (95% CI) (N)	Proprietary (95% CI) (N)	Design-based Pearson
Yes	59.0% (46.3-70.7) (2056)	43.0% (21.8-67.2) (259)	64.7% (37.7-84.8) (426)	$F_{2.0, 344.4}$=0.79 p=0.45
No	41.0% (29.3-53.7) (1429)	57.0% (32.8-78.2) (343)	35.3%* (15.2-62.4) (232)	

*Unreliable: standard error >30% of estimate

Table 13. *Proportion of U.S. Boarding EDs by Safety Net Status*

Boarding ED	Safety Net (95% CI) (N)	Non-Safety Net (95% CI) (N)	Design-based Pearson
Yes	56.2% (41.9-69.6) (1153)	59.1% (44.2-72.5) (1577)	$F_{1,175}$=0.09 p=0.77
No	43.8% (30.4-58.1) (898)	40.9% (27.5-55.8) (1091)	

Additionally, the data were analyzed to determine the proportion of boarding EDs by both aggregate number of hours spent on ambulance diversion and number of days that hospital elective surgeries were performed, but all resulting estimates were unreliable due to the magnitude of their standard errors. For the analyses in subsequent research questions, the variable for number of days that hospital elective surgeries were performed continued to produce unreliable results for all estimates and was therefore dropped from all analyses for this study.

Research Question Two

What is the total proportion of visits to U.S. EDs that result in patient boarding, and does this proportion vary by patient type, or by hospital, patient and community characteristics? Overall, of the 123,761,309 estimated visits to U.S. EDs in 2008, there were 13,656,488 visits that resulted in patient boarding, or 11.0% (see Table 8). Of the 8,100,308 estimated MHSA related visits, 21.5% resulted in patient boarding, while only 10.3% of non-MHSA related visits resulted in patient boarding. Table 14 below further describes the proportion of ED visits resulting in boarding by subpopulation for each visit type. Design-based Pearson F-tests for differences between the MHSA and non-MHSA subpopulations was significant for all visit types. This data demonstrates that a significantly greater proportion of MHSA related visits resulted in patient boarding overall, as well as within each distinct type of boarding visit.

Table 14. *Proportion of ED Visits Resulting in Boarding by Patient Type and Visit Type*

Visit Type	All Boarded Patients (95% CI) (N)	MHSA Patients (95% CI) (N)	Non-MHSA Patients (95% CI) (N)	Design-based Pearson (MHSA vs. Non-MHSA)
All Visit Types	11.0% (9.9-12.2) (13,656,488)	21.5% (18.9-24.2) (1,745,528)	10.3% (9.2-11.4) (11,910,960)	$F_{1, 175}$=150.2 p<0.0001

Admitted Only	4.0% (3.4-4.6) (4,891,349)	5.6% (4.4-7.2) (455,914)	3.8% (3.3-4.5) (4,435,435)	$F_{1,\ 175}$=11.29 p=0.001
Transferred Only	0.43% (.34-.55) (531,591)	4.4% (3.3-5.7) (352,167)	0.16% (0.11-0.22) (179,424)	$F_{1,\ 175}$=668.33 p<0.0001
Discharged Only	6.7% (6.0-7.4) (8,243,016)	11.6% (9.9-13.6) (939,458)	6.3% (5.7-7.0) (7,303,558)	$F_{1,\ 175}$=57.64 p<0.0001

Hospital Characteristics

Table 15 below provides a breakdown of the proportion of ED visits resulting in boarding for all visit types by U.S. region for all patients, as well as for the subgroups of MHSA patients and non-MHSA patients. More detailed results for each visit type (admitted boarder, transferred boarder, and discharged boarder) can be found in Tables J1-J3 in Appendix J. These figures demonstrate that the Northeast region consistently boarded a significantly higher proportion of ED patients across all visit types for the combined patient population, as well as both the MHSA and non-MHSA patient subpopulations; in the Northeast, nearly one in three MHSA related visits resulted in boarding in 2008.

Table 15. *Proportion of ED Visits Resulting in Boarding by Type and Region*

Visit Type	Northeast (95% CI) (N)	Midwest (95% CI) (N)	South (95% CI) (N)	West (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	14.6% (12.3-17.3) (3,589,476)	10.3% (7.7-13.7) (2,789,300)	9.7% (8.1-11.5) (4,653,151)	10.9% (8.6-13.8) (2,624,561)	$F_{2.8,\ 496}$=3.17 p=0.03
MHSA Patients, All Visit Types	30.6% (25.3-36.4) (476,041)	19.3% (12.7-28.0) (336,196)	19.9% (16.2-24.3) (556,442)	18.8% (14.9-23.5) (376,849)	$F_{2.5,\ 442.8}$=3.39 p=0.02
Non-MHSA Patients, All Visit Types	13.6% (11.2-16.3) (3,113,435)	9.7% (7.3-12.9) (2,453,104)	9.0% (7.5-10.8) (4,096,709)	10.2% (7.8-13.2) (2,247,712)	$F_{2.9,\ 507.2}$=2.73 p=0.045

Considering other hospital characteristics that describe differences in the proportion of visits resulting in patient boarding, Table 16 presents a breakdown of hospitals by metropolitan statistical area (MSA). Results are shown for the category of all visit types only, for the combined patient population as well as for the MHSA and non-MHSA subpopulations. Results detailing other visit types can be found in Tables J4-J6 in Appendix J. As shown in Table 16, the proportion of ED visits resulting in boarding was significantly higher in MSAs for all patient populations, and especially for MHSA related visits, where nearly one in four resulted in boarding.

Table 16. *Proportion of ED Visits Resulting in Boarding by Type and MSA Status*

Visit Type	MSA (95% CI) (N)	Non-MSA (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	12.3% (11.1-13.6) (12,733,921)	4.6% (3.0-7.1) (922,567)	$F_{1, 175}$=20.0 $p<0.0005$
MHSA Patients, All Visit Types	23.8% (21.1-26.7) (1,647,848)	8.4% (5.2-13.2) (97,680)	$F_{1, 175}$=22.0 $p<0.0005$
Non-MHSA Patients, All Visit Types	11.4% (10.3-12.7) (11,086,073)	4.4% (2.7-7.0) (824,887)	$F_{1, 175}$=16.5 $p=0.0001$

Table 17 below describes differences in the proportion of visits resulting in patient boarding by type of hospital ownership. Results are shown for the category of all visit types only, for the combined patient population as well as for the MHSA and non-MHSA subpopulations. Results detailing other visit types can be found in Tables J7-J9 in Appendix J. These figures demonstrate a pattern of increasingly higher proportions of boarding visits from proprietary to voluntary non-profit to government non-federal EDs.

For the MHSA subpopulation, almost one-third of all government non-federal ED visits resulted in boarding.

Table 17. *Proportion of ED Visits Resulting in Boarding by Type and Ownership*

Visit Type	Voluntary Non-Profit (95% CI) (N)	Government Non-Federal (95% CI) (N)	Proprietary (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	11.3% (10.1-12.6) (10,732,902)	14.4% (10.8-19.0) (2,028,619)	6.1% (4.3-8.7) (894,967)	$F_{1.9, 333.8}$=6.9 p=0.0015
MHSA Patients, All Visit Types	21.0% (18.1-24.3) (1,255,376)	29.6% (23.4-36.6) (375,469)	13.4% (8.0-21.6) (114,683)	$F_{1.97, 344}$=5.3 p=0.0057
Non-MHSA Patients, All Visit Types	10.6% (9.5-11.9) (9,477,526)	12.9% (9.5-17.4) (1,653,150)	5.7% (3.9-8.1) (780,284)	$F_{1.9, 332.7}$=5.8 p=0.004

Table 18 below describes differences in the proportion of visits resulting in patient boarding by the aggregate number of hours a hospital was on ambulance diversion in 2007. More detailed results for each visit type (admitted boarder, transferred boarder, and discharged boarder) can be found in Tables J10-J12 in Appendix J. Table 18 below demonstrates a consistent trend of significant, increasing proportions of ED boarding visits as the number of hours of ambulance diversion increased. Viewed conversely, the proportion of boarding patients is significantly associated with increasing use of ambulance diversion.

Table 18. *Proportion of ED Visits Resulting in Boarding by Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007*

Visit Type	0 Hours (95% CI) (N)	1-99 Hours (95% CI) (N)	100-499 Hours (95% CI) (N)	≥500 Hours (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	7.2% (5.9-8.9) (3,337,450)	9.6% (7.2-12.7) (1,963,403)	14.2% (11.5-17.5) (2,501,864)	17.4% (14.8-20.4) (3,025,074)	$F_{3.9, 680.3}$=11.5 p<0.0005

MHSA Patients, All Visit Types	11.3% (8.5-14.8) (303,050)	22.0% (16.3-29.0) (309,320)	28.6% (22.3-35.9) (402,623)	31.3% (25.3-38.1) (384,970)	$F_{3.8, 657.1}=8.5$ $p<0.0005$
Non-MHSA Patients, All Visit Types	7.0% (5.6-8.6) (3,034,400)	8.7% (6.5-11.6) (1,654,083)	13.0% (10.2-16.4) (2,099,241)	16.4% (13.6-19.6) (2,640,104)	$F_{3.9, 689.9}=10.0$ $p<0.0005$

The data were also analyzed for differences in the proportion of visits resulting in patient boarding by whether a hospital was a safety net hospital (defined as a hospital with either >30% Medicaid visits, >30% uninsured visits, or >40% combined Medicaid and uninsured visits). Surprisingly, there were no differences in proportions of visits that led to boarding by safety net status; results appear in Tables J13-J15 in Appendix J.

Patient Characteristics

Table 19 below describes differences in the proportion of visits resulting in patient boarding by age. More detailed results for each visit type (admitted boarder, transferred boarder, and discharged boarder) can be found in Tables J16-J18 in Appendix J. Table 19 demonstrates a trend of significantly increasing proportions of ED boarding visits as age increased. This is not surprising given the increased acuity and admission rate expected with advancing age. For the subpopulation of MHSA patients in the <15 year group, the proportion of ED visits resulting in boarding was nearly four times higher than for the same group in the non-MHSA subpopulation, while at older ages the proportion of MHSA patients boarded was only twice that of the non-MHSA subpopulation. This may be explained by the difficulty in finding psychiatric services for the pediatric population, as described by Mansbach, Wharff, Austin, Ginnis, and Woods (2003).

Table 19. *Proportion of ED Visits Resulting in Boarding by Type and Age*

Visit Type	<15 yr (95% CI) (N)	15-24 yr (95% CI) (N)	25-44 yr (95% CI) (N)	45-64 yr (95% CI) (N)	65-74 yr (95% CI) (N)	75+ yr (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	3.6% (2.8-4.7) (839,601)	7.9% (6.8-9.1) (1,561,135)	10.8% (9.5-12.2) (3,796,258)	15.3% (13.4-17.3) (4,016,670)	16.0% (13.6-18.7) (1,195,255)	19.1% (16.6-21.8) (2,247,569)	$F_{4.5, 778}$=73.9 p<0.0001
MHSA Patients, All Visit Types	15.2% (9.7-23.2) (52,582)	20.3% (16.1-25.3) (308,488)	20.5% (16.9-24.6) (632,119)	23.9% (19.9-28.4) (559,893)	24.6% (14.6-38.3) (69,669)	23.1% (16.2-31.8) (122,776)	$F_{4.8, 782}$=0.9 p=0.45
Non-MHSA Patients, All Visit Types	3.5% (2.7-4.4) (787,018)	6.9% (5.8-8.0) (1,252,647)	9.9% (8.7-11.2) (3,164,139)	14.4% (12.6-16.4) (3,456,777)	15.6% (13.2-18.5) (1,125,586)	18.9% (16.4-21.6) (2,124,793)	$F_{4.4, 765}$=78.7 p<0.0001

Table 20 below describes differences in the proportion of visits resulting in patient boarding by residence. More detailed results for each visit type (admitted boarder, transferred boarder, and discharged boarder) can be found in Tables J19-J21 in Appendix J. As seen in Table 20, patients who lived in private residences experienced a much lower proportion of boarding than did almost all other categories; not surprisingly, nursing home residents and the homeless experienced the highest proportion of boarding, with a noteworthy 43.4% of homeless MHSA related visits resulting in boarding.

Table 20. *Proportion of ED Visits Resulting in Boarding by Type and Residence*

Visit Type	Private Residence (95% CI) (N)	Other Residence (95% CI) (N)	Other Institution (95% CI) (N)	Nursing Home (95% CI) (N)	Homeless (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	10.4% (9.3-11.6) (11,791,262)	13.1% (9.2-18.5) (120,607)	17.2% (12.4-23.5) (164,154)	23.1% (18.8-28.0) (578,643)	28.4% (20.3-38.2) (154,596)	$F_{3.8, 666}$=29.2 p<0.0001
MHSA Patients, All Visit Types	20.5% (17.8-23.4) (1,390,168)	11.6%* (5.1-24.2) (19,684)	23.3% (12.5-39.4) (42,859)	27.5% (16.1-42.8) (68,398)	43.4% (29.3-58.7) (94,230)	$F_{3.6, 629}$=4.1 p=0.004
Non-MHSA Patients, All Visit Types	9.8% (8.7-11.0) (10,401,094)	13.5% (9.1-19.5) (100,923)	15.8% (11.0-22.1) (121,295)	22.6% (18.0-28.0) (510,245)	18.4% (10.7-29.9) (60,366)	$F_{3.7, 636}$=22.3 p<0.0001

*Unreliable: standard error >30% of estimate

The data were also analyzed to describe differences in the proportion of visits resulting in patient boarding by gender. While results were statistically significant for a higher proportion of boarding for females compared to males, the differences found were small and are therefore only presented in Tables J22-J24 in Appendix J. Likewise, results for differences in the proportion of visits resulting in patient boarding by race/ethnicity were either not significant, unreliable, or when found to be significant the differences were small. One noteworthy exception, however, was the proportion of MHSA related ED visits for all visit types, where results showed that 48.4% (95% CI 31.3-65.8) of MHSA visits by patients identifying as multiple race, and 40.6% (95% CI 22.4-61.9) by Asians, resulted in patient boarding, compared to 19.2% (95% CI 16.2-22.6) for non-Hispanic Whites ($F_{5.0, 873}$=3.6, p=0.0034). All results for race/ethnicity are presented in Tables J25-J27 in Appendix J.

Expected source of payment was also analyzed for differences in the proportion of visits resulting in boarding. Results are presented in Tables J28-J30 in Appendix J. While some statistically significant differences were found between categories, no overall trend emerged from the results, and in general differences found were small. Expected source of payment was further dichotomized into two groups: an insured group (private insurance, Medicare, worker's compensation, and other payment), and an uninsured group (Medicaid, self-pay, and no charge/charity). Analysis of the dichotomized group failed to produce any significant differences.

Finally, the data were analyzed to describe differences in the proportion of visits resulting in patient boarding by the number of previous times the patient was seen in the ED associated with the visit record in the last 12 months. Results appear in Tables J31-

J33 in Appendix J. Surprisingly, statistically significant differences were small, when present, and no meaningful trend was found.

Patient's Community Characteristics

The data were analyzed to describe differences in the proportion of visits resulting in patient boarding by both (1) the level of poverty and (2) the median household income in the patient's ZIP code, but results were unremarkable, with no statistically significant differences. Results appear in Tables J34-J39 in Appendix J. The data were also analyzed for differences in the proportion of visits resulting in patient boarding by the percent of adults with a Bachelor's degree or higher in the patient's ZIP code. Results, shown in Table 21, demonstrate an unexpected, statistically significant association between higher education and longer boarding. More detailed results appear in Tables J40-J42 in Appendix J.

Table 21. *Proportion of ED Visits Resulting in Boarding by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code*

Visit Type	<12.84% (95% CI) (N)	12.84%-19.66% (95% CI) (N)	19.67%-31.68% (95% CI) (N)	≥31.69% (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	9.8% (8.3-11.7) (3,371,882)	9.9% (8.4-11.6) (3,076,412)	12.0% (10.4-13.7) (3,234,799)	12.5% (10.8-14.5) (2,846,632)	$F_{2.7, 460}$=3.5 p=0.02
MHSA Patients, All Visit Types	20.1% (16.4-25.9) (433,263)	17.4% (12.8-23.1) (344,302)	20.3% (15.8-25.6) (369,859)	26.5% (21.7-31.9) (407,448)	$F_{2.9, 500}$=2.1 p=0.0999
Non-MHSA Patients, All Visit Types	9.1% (7.6-10.9) (2,938,619)	9.4% (7.9-11.1) (2,732,110)	11.4% (9.8-13.1) (2,864,940)	11.5% (9.8-13.4) (2,439,184)	$F_{2.7, 467}$=3.1 p=0.03

Finally, differences in the proportion of visits resulting in patient boarding by the urban-rural classification of the patient's ZIP code were analyzed. Results, in Table 22 below, demonstrate that, as population density increased from rural to urban, proportions of boarding visits also increased. Most notably, results show that 27.2% of MHSA visits to large central metro EDs resulted in patient boarding. More detailed results can be found in Tables J43-J45 in Appendix J.

Table 22. *Proportion of ED Visits Resulting in Boarding by the Urban-Rural Classification of the Patient's ZIP Code*

Visit Type	Large Central Metro (95% CI) (N)	Large Fringe Metro (95% CI) (N)	Medium Metro (95% CI) (N)	Small Metro (95% CI) (N)	Non-Metro and Micro-politan (95% CI) (N)	Design-based Pearson
All Patients, All Visit Types	15.1% (13.1-17.3) (4,509,420)	12.2% (10.5-14.2) (3,155,944)	10.2% (8.4-12.4) (3,424,221)	7.8% (5.1-11.6) (563,396)	5.6% (4.3-7.3) (1,197,457)	$F_{3.7, 363}$=12.8 p<0.0001
MHSA Patients, All Visit Types	27.2% (23.2-31.6) (607,337)	23.6% (18.0-30.3) (372,467)	20.9% (16.4-26.3) (432,275)	10.2%* (5.1-19.6) (47,566)	10.7% (7.4-15.2) (133,641)	$F_{3.7, 653}$=6.7 p<0.0001
Non-MHSA Patients, All Visit Types	14.1% (12.1-16.3) (3,902,083)	11.5% (9.8-13.5) (2,783,477)	9.5% (7.7-11.6) (2,991,946)	7.6% (5.0-11.4) (515,830)	5.3% (4.0-6.9) (1,063,816)	$F_{3.7, 649}$=11.5 p<0.0001

*Unreliable: standard error >30% of estimate

Research Question Three

For those patients who board in U.S. EDs, how long does the average patient board, and does this time vary by patient type, or by hospital, patient and community characteristics? Overall, of the 13,656,488 estimated visits to U.S. EDs that resulted in boarding in 2008, the mean boarding time (with boarding time defined as time spent in the ED in excess of 6 hours and not including this first 6 hours), was 216 minutes. For the subpopulation of 1,745,528 estimated MHSA related boarding visits, the mean boarding time was 293 minutes; for the subpopulation of 11,910,960 estimated non-MHSA related boarding visits, the mean boarding time was 205 minutes. These results appear in Table 23 below, with the greatest difference found in the group of boarded patients ultimately discharged directly from the ED, where MHSA patients boarded for over two hours longer than non-MHSA patients (308.5 minutes vs. 178.3 minutes).

Table 23. *Mean Patient Boarding Time in Minutes by Patient Type and Visit Type*

Visit Type	All Boarded Patients (95% CI) (N)	MHSA Patients (95% CI) (N)	Non-MHSA Patients (95% CI) (N)	Pearson (MHSA vs. Non-MHSA)
All Visit Types	216.2 (191.5-240.9) (13,656,488)	292.7 (254.8-330.5) (1,745,528)	205.0 (177.2-232.8) (11,910,960)	$F_{1, 174}$=13.42 p=0.0003
Admitted Only	253.1 (194.1-312.1) (4,891,349)	293.9 (227.8-360.0) (455,914)	248.9 (184.6-313.2) (4,435,435)	$F_{1, 149}$=1.02 p=0.31
Transferred Only	233.6 (169.5-297.8) (531,591)	250.7 (178.8-322.7) (352,167)	200.1 (73.6-326.7) (179,424)	$F_{1, 69}$=0.47 p=0.49
Discharged Only	193.1 (173.8-212.4) (8,243,016)	308.5 (258.8-358.3) (939,458)	178.3 (158.4-198.2) (7,303,558)	$F_{1, 173}$=22.76 p<0.0001

Hospital Characteristics

Table 24 below provides a breakdown of the mean patient boarding time for all visit types by U.S. region for all patients, as well as for the subgroups of MHSA patients and non-MHSA patients. More detailed results for each visit type (admitted boarder, transferred boarder, and discharged boarder) can be found in Tables J46-J48 in Appendix J. These results illustrate that the Northeast region boarded MHSA patients for significantly longer than other regions, with an average of over two and one-half hours more boarding for MHSA patients than the South region.

Table 24. *Mean Patient Boarding Time in Minutes by Type and Region (N=13,656,488*)

Visit Type	Northeast (95% CI)	Midwest (95% CI)	West (95% CI)	South (95% CI)	Pearson
All Patients, All Visit Types	259.1 (186.9-331.2)	231.7 (196.0-267.4)	193.3 (147.8-238.8)	186.8 (163.9-209.7)	$F_{3, 172}$=2.30 p=0.08
MHSA Patients, All Visit Types	381.3 (316.0-446.6)	270.7 (188.4-352.9)	294.6 (190.6-398.7)	228.8 (180.4-277.2)	$F_{3, 127}$=4.52 p=0.0048
Non-MHSA Patients, All Visit Types	240.4 (154.3-326.5)	226.3 (188.7-264.0)	176.3 (131.4-221.3)	181.1 (156.1-206.1)	$F_{3, 171}$=1.86 p=0.14

Table 25 below describes differences in the mean patient boarding time by type of hospital ownership. Results show a statistically significant difference for the subpopulation of MHSA patients, with those visiting government non-federal EDs boarding for about two hours longer on average. More detailed results for each visit type (admitted boarder, transferred boarder, and discharged boarder) can be found in Tables J49-J51 in Appendix J.

Table 25. *Mean Patient Boarding Time in Minutes by Type and Ownership (N=13,656,488)*

Visit Type	Voluntary Non-Profit (95% CI)	Government Non-Federal (95% CI)	Proprietary (95% CI)	Pearson
All Patients, All Visit Types	211.6 (181.3-241.9)	254.5 (215.6-293.3)	185.1 (140.6-229.6)	$F_{2, 173}=2.82$ p=0.06
MHSA Patients, All Visit Types	265.1 (222.8-307.5)	389.4 (303.4-475.5)	277.3 (180.3-374.4)	$F_{2, 128}=3.25$ p=0.04
Non-MHSA Patients, All Visit Types	204.5 (170.5-238.5)	223.8 (186.2-261.4)	171.5 (126.6-216.5)	$F_{2, 172}=1.54$ p=0.22

The data were also analyzed for differences in mean patient boarding time by whether hospitals were located in a metropolitan statistical area (MSA). Results were unremarkable with the exception of transfer patients: in MSAs, transfer patients boarded for an average of 267.1 minutes, compared to 101.9 minutes in non-MSAs. More detailed results appear in Tables J52-J54 in Appendix J. Finally, analyses were conducted for differences in the mean patient boarding time by (1) the aggregate number of hours the hospital was on ambulance diversion in 2007, and (2) whether the hospital was a safety net hospital, but neither variable produced any statistically significant differences among the groups. Detailed results for each can be found in Tables J55-J60 in Appendix J.

Patient Characteristics

Differences in mean patient boarding time were analyzed by patient residence. Selected results appear below in Table 26 with more detailed results appearing in Tables J61-J63 in Appendix J. Table 26 shows a significant difference between groups for the population of all patients, most likely attributed to the even larger difference shown for the subpopulation of MHSA patients ($F_{4, 122}$=6.41, p=0.0001). For the MHSA subpopulation, both the homeless group (552.6 minutes) and the other residence group (718.6 minutes) boarded for much longer than all other groups; the similarity between these groups may be attributed to the NHAMCS definition of other residence as “the patient’s current place of residence is a hotel, college dormitory, assisted living center, etc.” (CDC, 2008, p. 124). By including hotels in the other residence category, this category may largely represent patients from single resident occupancy tenant buildings, a population that may have similar characteristics, healthcare needs and utilization trends as the homeless.

Table 26. *Mean Patient Boarding Time in Minutes by Type and Residence (N=13,656,488)*

Visit Type	Private Residence (95% CI)	Nursing Home (95% CI)	Other Institution (95% CI)	Other Residence (95% CI)	Homeless (95% CI)	Pearson
All Patients, All Visit Types	210.6 (185.2-236.0)	214.5 (158.9-270.1)	283.3 (174.4-392.1)	268.5 (137.9-399.0)	418.8 (327.1-510.5)	$F_{4, 170}$=5.03 p=0.0007
MHSA Patients, All Visit Types	260.2 (224.6-295.7)	222.0 (130.4-313.7)	394.1 (188.5-599.7)	718.6 (316.2-1120.9)	552.6 (433.6-671.6)	$F_{4, 122}$=6.41 p=0.0001
Non-MHSA Patients, All Visit Types	204.0 (175.6-232.4)	213.4 (153.2-273.7)	244.1 (128.8-359.4)	180.7 (120.5-240.9)	210.0 (136.0-284.0)	$F_{4, 169}$=0.26 p=0.90

Further analyses to test for differences in mean patient boarding time by patient race/ethnicity were performed. Unfortunately, the results for all groups except non-

Hispanic White and non-Hispanic Black were largely unreliable due to the magnitude of their standard errors (all results appear in Tables J64-J66 in Appendix J). However, for the MHSA subpopulation, it appeared as if there was a trend toward longer boarding times between two distinct groups, so groups were combined into the following dichotomy based on the trend: (Group 1) non-Hispanic White, non-Hispanic Black, and Hispanic vs. (Group 2) Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, and multiple races. This resulted in reliable results with a significant difference between the two groups for only the MHSA subpopulation, with Group 2 boarding for just over three hours longer than Group 1. Results appear in Table 27 below.

Table 27. *Mean Patient Boarding Time in Minutes by Dichotomized Race/Ethnicity (Group 1: Non-Hispanic White, Non-Hispanic Black, and Hispanic vs. Group 2: Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, and Multiple Races (N=13,656,488)*

Visit Type	Group 1 (95% CI)	Group 2 (95% CI)	Pearson
All Patients, All Visit Types	214.1 (188.5-239.6)	262.2 (211.8-312.7)	$F_{1, 174}=3.06$ $p=0.08$
MHSA Patients, All Visit Types	281.1 (244.7-317.6)	462.8 (333.9-591.7)	$F_{1,129}=7.86$ $p=0.0058$
Non-MHSA Patients, All Visit Types	204.5 (175.7-233.2)	217.6 (167.3-268.0)	$F_{1, 173}=0.22$ $p=0.64$

Differences in mean patient boarding time were also analyzed for differences by expected source of payment. Again, results for many of the smaller groups proved unreliable due to the magnitude of their standard errors, and results were largely unremarkable (shown in Tables J67-J69 in Appendix J). The data were further analyzed according to the dichotomy for this variable that was created for research question three:

an insured group (private insurance, Medicare, worker's compensation, and other payment), and an uninsured group (Medicaid, self-pay, and no charge/charity). Results for this dichotomy were reliable and showed a significant difference for the group of transferred boarders only ($F_{1, 67}$=4.51, p=0.0374), with the insured group boarding for an average of 193.0 minutes (95% CI 116.4-269.7) vs. the uninsured group boarding for 341.1 (95% CI 225.3-456.9).

Finally, the data were analyzed for differences in mean patient boarding time by age, gender, and the number of previous times the patient was seen in the ED associated with the visit record in the last 12 months. Results were unremarkable for all three variables. They appear in Tables J70-J78 in Appendix J.

Patient's Community Characteristics

The data were analyzed for differences in mean patient boarding time by the level of poverty in the patient's ZIP code. The only notable results were for the subgroup of admitted patients, as seen in Table 28 below, where there was a trend toward longer average boarding times as the level of community poverty increased. All results can be seen in Tables J79-J81 in Appendix J.

Table 28. *Mean Patient Boarding Time in Minutes by Level of Poverty in Patient's ZIP Code (N=12,529,729)*

Visit Type	<5.0% (95% CI)	5.0-9.9% (95% CI)	10.0-19.9% (95% CI)	≥20% (95% CI)	Pearson
All Patients, Admitted Only	228.8 (150.6-307.0)	231.1 (179.0-283.2)	219.1 (160.4-277.7)	363.7 (201.5-525.8)	$F_{3, 141}$=2.37 p=0.07
MHSA Patients, Admitted Only	162.6 (118.6-206.6)	267.8 (164.8-370.9)	351.9 (149.0-554.8)	347.5 (229.7-465.4)	$F_{3, 62}$=3.87 p=0.0134
Non-MHSA Patients, Admitted Only	236.7 (149.5-323.8)	227.8 (171.3-284.3)	209.6 (148.8-270.3)	366.3 (179.3-553.2)	$F_{3, 138}$=2.45 p=0.07

Differences in mean patient boarding time were also analyzed by the urban-rural classification of the patient's ZIP code. As seen in Table 29 below, there was an overall trend downward as population density decreased; however, non-MHSA patients in non-metropolitan areas trended sharply upward whereas MHSA patients in non-metropolitan areas trended sharply downward. More detailed results can be seen in Tables J82-J84 in Appendix J.

Table 29. *Mean Patient Boarding Time in Minutes by the Urban-Rural Classification of the Patient's ZIP Code (N=12,850,438*)

Visit Type	Large Central Metro (95% CI)	Large Fringe Metro (95% CI)	Medium Metro (95% CI)	Small Metro (95% CI)	Non-Metro and Micropolitan (95% CI)	Pearson
All Patients, All Visit Types	239.0 (181.2-296.8)	202.9 (168.6-237.1)	201.8 (177.3-226.4)	141.8 (108.7-174.8)	211.9 (140.6-283.2)	$F_{4, 168}$=3.25 p=0.0135
MHSA Patients, All Visit Types	339.4 (268.8-410.1)	229.6 (172.7-286.6)	291.3 (220.6-362.0)	241.2 (136.2-346.2)	136.3* (41.1-231.5)	$F_{4, 121}$=3.20 p=0.0154
Non-MHSA Patients, All Visit Types	223.4 (157.0-289.8)	199.2 (160.6-237.9)	188.9 (162.0-215.8)	132.6 (102.7-162.5)	221.4 (149.8-293.0)	$F_{4, 167}$=3.51 p=0.0088

*Unreliable: standard error >30% of estimate

Additional analyses for differences in mean patient boarding time by both (1) median household income and (2) the percent of adults with a Bachelor's degree or higher in the patient's ZIP code produced unremarkable results. Tables J85-J90 in Appendix J show details of the results for each variable.

Research Question Four

What is the total amount of ED boarding time in the U.S. annually? Overall, of the 395 million hours of estimated visit time to U.S. EDs in 2008, 49.2 million hours were spent boarding. Thus, as a proportion, it is estimated that 12.5% of all visit time to U.S. EDs in 2008 was spent boarding. For the subpopulation of MHSA related visits, the proportion of total boarding time to total visit time was almost twice as much, with

23.7% of all MHSA related ED visit time spent boarding. These figures are presented in more detail in Tables 30-32, broken down by visit type (all boarders, admitted boarders, transferred boarders, and discharged boarders), for all patients (Table 30), as well as for the subgroups of MHSA patients (Table 31) and non-MHSA patients (Table 32):

Table 30. *Total Annual ED Patient Boarding Time (in Millions of Hours) vs. Total Annual ED Patient Visit Time (in Millions of Hours) by Type*

Visit Type	Total Boarding Time (95% CI) (N)	Total Visit Time (95% CI) (N)	Proportion Boarding Time/ Total Time
All Visit Types	49.2 (43.6-54.8) (13,656,488)	395.0 (377.5-412.5) (123,761,419)	12.5%
Admitted Only	20.6 (15.8-25.4) (4,891,349)	86.5 (78.0-94.9) (16,569,777)	23.9%
Transferred Only	2.1 (1.5-2.6) (531,591)	9.6 (8.5-10.7) (2,086,123)	21.6%
Discharged Only	26.5 (23.9-29.2) (8,243,016)	299.2 (287.6-310.8) (105,164,565)	8.9%

Table 31. *MHSA Total Annual ED Patient Boarding Time (in Millions of Hours) vs. MHSA Total Annual ED Patient Visit Time (in Millions of Hours) by Type*

Visit Type	Total Boarding Time (95% CI) (N)	Total Visit Time (95% CI) (N)	Proportion Boarding Time/ Total Time
All Visit Types	8.5 (7.4-9.6) (1,745,528)	36.0 (33.6-38.3) (8,100,308)	23.7%
Admitted Only	2.2 (1.7-2.7) (455,914)	8.0 (7.0-9.0) (1,508,058)	27.9%
Transferred Only	1.5 (1.0-1.9) (352,167)	4.9 (4.2-5.6) (761,504)	30.1%
Discharged Only	4.8 (4.1-5.6) (939,458)	23.1 (21.4-24.9) (5,844,406)	20.9%

Table 32. *Non-MHSA Total Annual ED Patient Boarding Time (in Millions of Hours) vs. Non-MHSA Total Annual ED Patient Visit Time (in Millions of Hours) by Type*

Visit Type	Total Boarding Time (95% CI) (N)	Total Visit Time (95% CI) (N)	Proportion Boarding Time/ Total Time
All Visit Types	40.7 (35.2-46.2) (11,910,960)	359.0 (342.6-375.5) (115,661,111)	11.3%
Admitted Only	18.4 (13.6-23.2) (4,435,435)	78.4 (70.2-86.7) (15,061,719)	23.5%
Transferred Only	0.60* (0.22-0.98) (179,424)	5.1 (4.1-5.3) (1,324,619)	11.7%
Discharged Only	21.7 (19.3-24.1) (7,303,558)	276.1 (265.4-286.7) (99,320,159)	7.9%

*Unreliable: standard error >30% of estimate

Research Question Five

What are the relationships among patient, hospital, and community characteristics and ED boarding? To answer this research question, multilevel regression analyses were conducted using Mplus version 6.11 (Muthén & Muthén, Los Angeles, CA). The dependent variable, boarding time (in hours), was regressed on patient and patient's community characteristics as level one predictors, and hospital characteristics as level two predictors. Rather than creating separate models for MHSA and non-MHSA subpopulations, the entire population of boarded patients was tested with the variable MHSA retained in all models as a predictor, and also tested for interactions with all other variables. This approach was chosen because it led to a more parsimonious representation, as results can be expressed within a single final model. The model was built in an iterative fashion, with boarding time regressed on each predictor individually (again, with MHSA also in each model and testing for any interaction between each predictor and MHSA individually) prior to compilation of the final model. Results are presented below in the order of the iterations and building up to the final model.

Level One Predictors

Each of the variables for patient and patient's community characteristics (see Tables 6-7 in Chapter 3) were individually tested for significance as predictors of boarding time, and also tested for significant interactions with the patient characteristic MHSA. The only variables that significantly predicted boarding time at level one were MHSA and the within-level interaction between MHSA and residence. Preliminary analysis of residence indicated that the only significant category was the homeless population; therefore, to simplify presentation and interpretation, the variable for residence was dichotomized to homeless and non-homeless. Results are shown in Table 33 below.

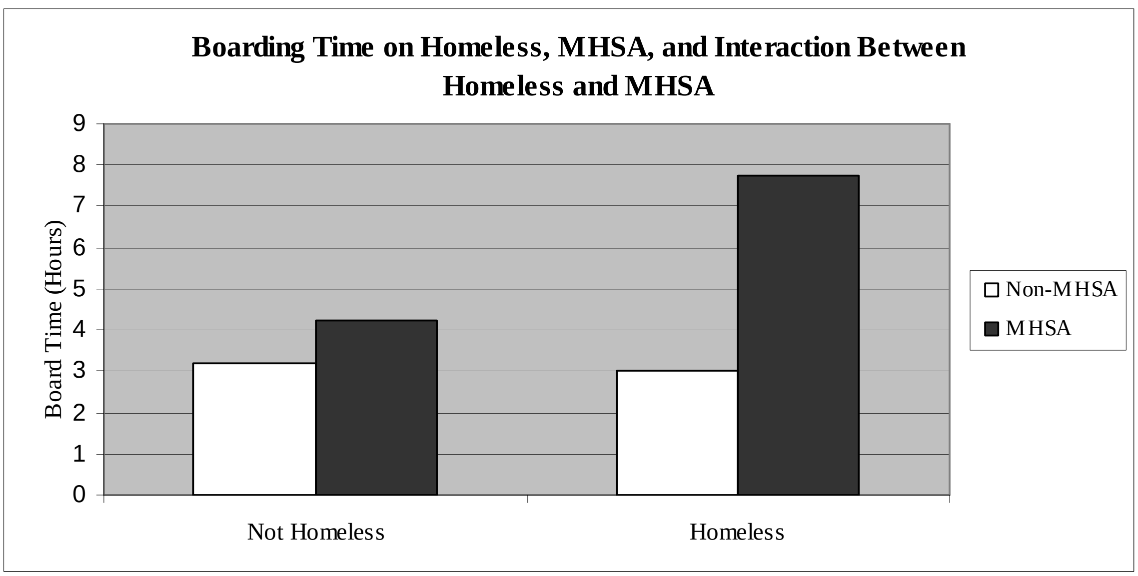
Because the interaction between the predictors for MHSA and homelessness (MHSAxHomeless) is significant, it is not appropriate to interpret the main effect of either of these variables on their own, as such an interpretation would be misleading. Therefore, interpreting Table 33, the intercept represents the number of hours of boarding when all predictors are equal to zero—i.e., 3.2 hours of boarding time for a non-MHSA non-homeless patient. For MHSA homeless patients, boarding time is the sum of all coefficients, or 7.7 hours of boarding time. For MHSA patients who are not homeless, boarding time is the sum of the intercept and the coefficient for MHSA, or 4.2 hours of boarding time. For non-MHSA patients who are homeless, boarding time is the sum of the intercept and the coefficient for homeless, or 3.0 hours of boarding time; however, the fact that the coefficient for homeless is not significant on its own indicates a nonsignificant difference between homeless and non-homeless patients who are not MHSA patients. To aid in interpretation, Figure 2 is a graphical representation of the data from Table 33.

Table 33. *Results for Boarding Time on Homeless Status, MHSA Status, and Interaction Between Homeless and MHSA*

Parameter	Estimate	S.E.	Est./S.E.	Sig.
Intercept	3.197	0.235	13.589	<0.001
Within Level				
MHSA	1.045	0.335	3.123	0.002
Homeless	-0.178	0.526	-0.338	0.736
MHSAxHomeless	3.660	1.086	3.369	0.001

*Dependent Variable: Board Time (in hours)

Figure 2. *Results for Boarding Time on Homeless and MHSA Status (Interaction Model)*



Level Two Predictors

All variables for hospital characteristics (see Table 5 in Chapter 3) were also individually tested as predictors of boarding time (again with MHSA in each model), as well as for significant cross-level interactions with MHSA. Only region was found to be a significant level two predictor, and only as a main effect. Preliminary analysis revealed that the West was the only region that was significant, compared to the others; therefore, the variable region was dichotomized to West versus all other regions to achieve a more parsimonious model. Results are shown in Table 34 and Figure 3 below.

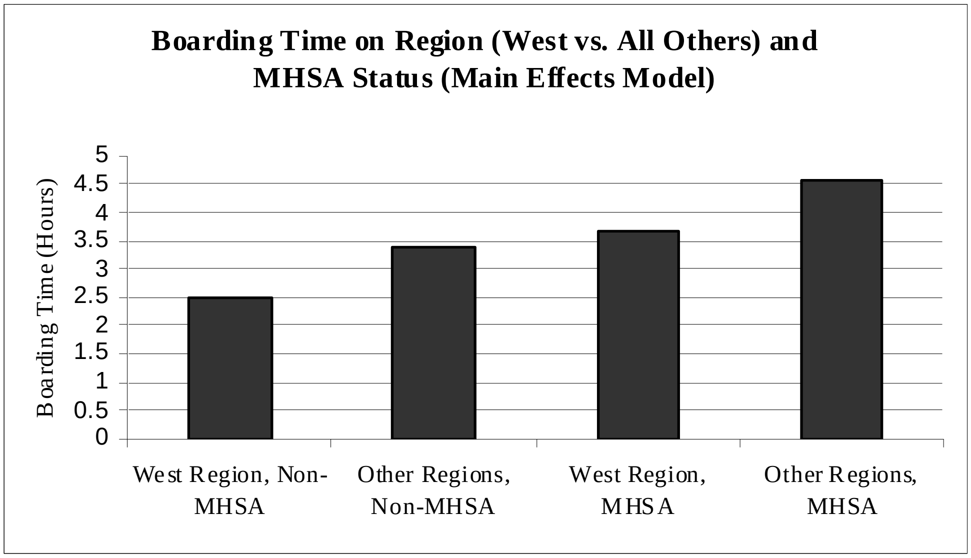
As shown in Table 34, the intercept indicates that boarding patients in regions other than the West experience approximately 3.4 hours of boarding. The coefficient for the West is significant, indicating that patients in the West board for about 0.9 hours less than patients in all other regions. The main effect of MHSA at level one remains significant, with no cross-level interaction, indicating that MHSA patients experience 1.2 hours more boarding time than their non-MHSA counterparts regardless of region. To aid in interpretation, Figure 3 is a graphical representation of the data from Table 34.

Table 34. *Results for Boarding Time on Region (West vs. All Others) and MHSA Status (Main Effects Model)*

Parameter	Estimate	S.E.	Est./S.E.	Sig.
Intercept	3.374	0.269	12.532	<0.001
Within Level				
MHSA	1.209	0.337	3.583	<0.001
Between Level				
West	-0.890	0.434	-2.053	0.040

*Dependent Variable: Board Time (in hours)

Figure 3. *Results for Boarding Time on Region (West vs. All Others) and MHSA Status (Main Effects Model)*



Composite Multilevel Model

Finally, a composite multilevel model was created from the above level one and level two predictors, using the approach for model building described by Hosmer and Lemeshow (2000). The significant interaction between the indicators for MHSA and homelessness (MHSAxHomeless) requires the coefficients for these variables to be interpreted along with coefficient for the interaction term in order for their effects to be accurately understood; the same is true of the indicators for MHSA and region (West) and the interaction between them (MHSAxWest). As Table 35 shows, the intercept indicates an average boarding time of 3.3 hours for non-MHSA patients who are not homeless in regions other than the West. For the level one variables, the coefficient for MHSA is significant, indicating an increase in boarding time of approximately 1.4 hours for MHSA patients. The coefficient for homeless patients is not significant; however, the interaction term MHSAxHomeless is significant, demonstrating that the relationship between homelessness and boarding time depends on MHSA status. For homeless MHSA patients, the average boarding time increases by an additional 3.8 hours. Examining the level two variables, similar to the predictor for homelessness, there is a significant interaction between region and MHSA status, indicating that region is a significant moderator in the model. Interpreting this effect, boarding time is about 1.4 hours less for patients who are both MHSA and live in the West region; however, the fact that the coefficient for West is not significant on its own indicates a nonsignificant difference between patients in the West and patients in all other regions who are not MHSA patients.

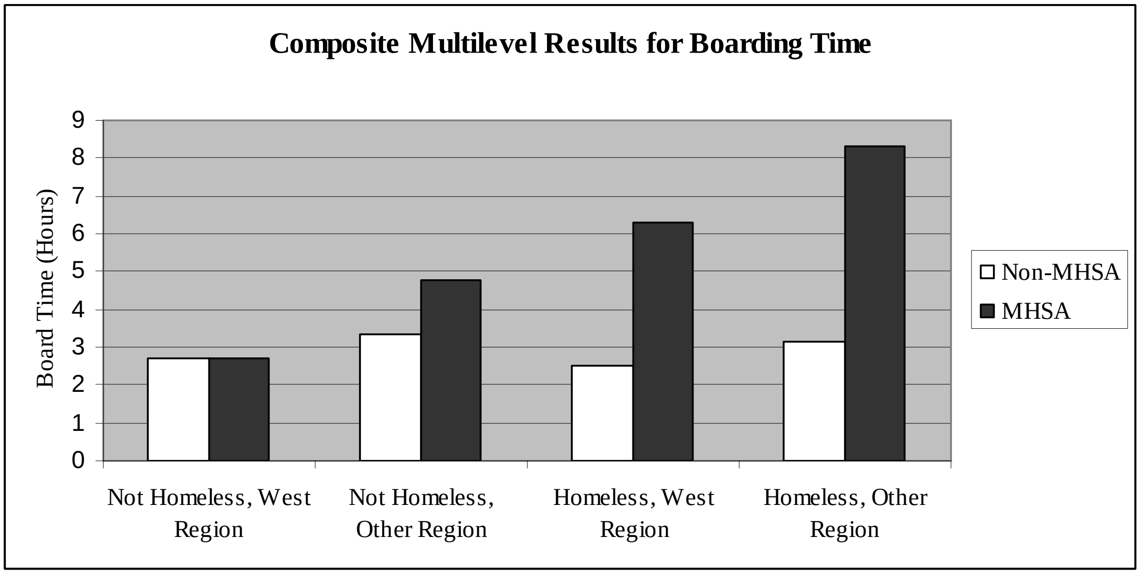
In constructing the composite model, two final iterations were performed to test for interactions between the predictors for homelessness and region (HomelessxWest), and for a three way interaction between all predictors in the model (MHSAxHomelessxWest). Tests for these interactions were not significant, and Table 35 represents the final multilevel model. To aid in interpretation, Figure 4 below graphically represents the mean boarding times for the various patient and hospital characteristic combinations from the model.

Table 35. *Composite Multilevel Results for Boarding Time*

Parameter	Estimate	S.E.	Est./S.E.	Sig.
Intercept	3.335	0.271	12.285	<0.001
Within Level				
MHSA	1.411	0.368	3.828	<0.001
Homeless	-0.172	0.538	-0.320	0.749
MHSAxHomeless	3.759	1.123	3.347	0.001
Between Level				
West	-0.650	0.481	-1.352	0.176
MHSAxWest	-1.391	0.710	-1.961	0.050

*Dependent Variable: Board Time (in hours)

Figure 4. *Composite Multilevel Results for Boarding Time*



In light of the multitude of significant differences between group characteristics indicated by the results of the bivariate analyses from research questions 1-4, it was anticipated that the composite multilevel model would mirror these relationships and produce an elegant model with many significant variables. However, as demonstrated above, this was not the case, and results of the multilevel multivariate regression analysis were somewhat disappointing. The differences noted between the relationships found by the bivariate analyses and the multilevel multivariate analyses are an important finding in themselves. This point is discussed in greater detail in the next chapter.

In conclusion, these five research questions were answered in order to gain understanding about U.S. boarding practices on a national level, with particular interest in the subpopulation of mental health and substance abuse patients. Results of these analyses demonstrate significant differences in both the proportion of patients boarded, and length of boarding, according to hospital, patient, and community characteristics. The importance of these results, their implications for practice, policy, research, and theory, and the limitations of this study will be discussed below.

Chapter Five: Discussion

A factor commonly associated with emergency department crowding (EDC) is the practice of boarding admitted patients (Fatovich et al., 2005; Forster et al., 2003; GAO, 2003; Lewin Group, 2002; Lucas, Farley, Twanmoh, Urumov, Olsen et al., 2009; Schull, Lazier et al., 2003). However, almost no quantitative data exists describing the characteristics or extent of this practice on a national level in the U.S. (General Accounting Office, 2003; Institute of Medicine, 2006). Even less is understood about the boarding of the subpopulation of mental health and substance abuse patients (Lewin Group, 2008).

Therefore, the purpose of this study was to better understand U.S. ED boarding practices on a national level. To meet this purpose, the study described ED boarding practices for the U.S. patient population overall, and for the subpopulation of mental health and substance abuse patients, using a dataset capable of national probability estimates (CDC, 2008). While results of this analysis yielded many expected findings, there were many unanticipated findings as well. Highlights of the results of this study are discussed below for each research question.

Discussion of the Results

Research Question One: What is the proportion of U.S. EDs that board patients? Establishing the proportion of U.S. EDs that board patients was an important, and overdue, gap to fill in the literature. Very little data exists about the extent of ED boarding on a national level, yet in one of the largest U.S. surveys regarding EDC, boarding of admitted patients was the most commonly cited reason for crowding (GAO, 2003). Furthermore, in position statements, leading professional ED associations have cited boarding as a major contributor to EDC (American College of Emergency Physicians, 2006; Eitel, Rudkin, Malvehy, Killeen & Pines, 2010; Emergency Nurses Association, 2006). Without quantitative data characterizing the extent of the practice, it has been difficult to determine if these claims are justified.

In order to answer this question, a boarding ED was defined as an ED for which >4% of all visits sampled resulted in ED stays of >6 hours. Using this definition, it was determined that 57.8% of all U.S. EDs boarded patients in 2008. This figure indicates that a majority of our nation's EDs experience boarding, and goes far toward validating the findings of the GAO and the position statements of leading ED associations. It was further determined that the Northeast (79.7%) and the West (75.6%) had a significantly higher proportion of boarding EDs than the South (55.7%) and the Midwest (38.8%). Further research is needed to understand why these regional differences exist, as such an understanding could inform decisions geared toward improving the problem.

Another important difference that emerged in answering this research question is that significantly more EDs in metropolitan statistical areas (MSAs) boarded patients (74.0%) than EDs in non-MSAs (26.9%). This finding could help administrators, researchers, and policymakers narrow their focus on solutions to those that specifically target EDs in MSAs. A surprising result in the analysis of this research question was that neither type of hospital ownership, nor safety net status, resulted in significant differences in the proportion of boarding EDs. This finding is noteworthy as it was expected that both private and non-safety net hospitals would have lower proportions of boarding EDs; the contrary result suggests that ED boarding may be more widespread and difficult to control than previously thought, as hospitals that are typically considered more resource-rich appear to suffer on par with those considered more burdened and less nimble.

Finally, it was disappointing that it was not possible to produce reliable estimates for the difference in the proportion of boarding EDs by the aggregate number of hours spent on ambulance diversion, as this variable has been shown to be associated with EDC measures in studies based on local area results (Fatovich et al., 2005; Schull, Lazier et al., 2003). It was expected that EDs with increased ambulance diversion times would have increased proportions of boarding. It would have been useful to determine if results based on this national dataset reaffirmed those found by smaller studies.

Research Question Two: *What is the total proportion of visits to U.S. EDs that result in patient boarding, and does this proportion vary by patient type, or by hospital, patient and community characteristics?* Like the previous research question, it was important to answer this question to establish the extent of boarding on a national level. Establishing these figures not only serves to justify current practices based largely on assumptions, but also creates a benchmark by which the success or failure of future interventions can be gauged.

With only a few foreign studies (Bullard et al., 2009; Fatovich & Hirsch, 2003) based on local area data from which to draw, it was difficult to anticipate what the data might show. While the finding that 11.0% of all ED visits resulted in patient boarding seems somewhat high, the fact that over half of these visits (6.7% of all visits) were boarders that were ultimately discharged directly from the ED moderates this finding. It should be noted that it is possible that many of these patients ultimately discharged directly from the ED may have been lower acuity patients that visited EDs on very busy days and met the criterion for boarding simply by virtue of a stay in the ED of >6 hours. Without more standardized data collection practices and more cohesive information systems, more precise results will continue to be elusive.

Regardless, there are several important findings regarding the characterization of differences in the proportion of visits resulting in ED boarding. Foremost among these is the fact that such a striking difference was found between the proportion of overall visits resulting in boarding in the MHSA subpopulation (21.5%) and the non-MHSA subpopulation (10.3%). While it was anticipated that this difference would emerge based on past research (American College of Emergency Physicians, 2008; Lewin Group, 2008; Lewin Group, 2009; Owens, Mutter et al., 2010), the magnitude of the difference found was surprising. Such a large disparity highlights the need for a redoubling of efforts toward solutions to address MHSA boarding. These efforts should be especially focused in the Northeast region, where nearly one in three MHSA related visits resulted in patient boarding.

Other noteworthy results include the finding that, as in the case of research question one, the proportion of visits resulting in boarding was higher for metropolitan statistical areas (12.3%) than for non-MSAs (4.6%), especially for the mental health/substance abuse subpopulation (23.8% vs. 8.4%). This finding is reinforced by results showing a greater proportion of visits resulting in boarding by patients with urban ZIP codes (15.1%) compared to rural ZIP codes (5.6%), and again, especially for the MHSA subpopulation (27.2% vs. 10.7%, respectively). These findings indicate a need for a refinement in the focus of efforts specifically geared toward addressing boarding of MHSA patients in metropolitan areas.

While type of ownership failed to lead to significant differences in research question one, it did result in differences for research question two. An expected trend of increasing proportions of boarded patients from proprietary (6.1%) to voluntary non-profit (11.3%) to government non-federal hospitals (14.4%) emerged; however, these differences were much more pronounced for the MHSA subpopulation (13.4% vs. 21.0% vs. 29.6%, respectively). This highlights the need for a focus on efforts aimed at the non-proprietary sector, and especially geared toward the MHSA population. Another expected result was the disparity in proportion of visits resulting in boarding between patients living in private residences and the homeless; however, the differences found were striking: 10.4% of all visits from private residences resulted in boarding, compared to 28.4% for the homeless; for the MHSA subpopulation, 20.5% of all visits from private residences resulted in boarding versus 43.4% for the homeless. These large differences underscore the fact that our healthcare system has far to go toward achieving equity in service to the homeless. It is truly remarkable that *43.4% of all MHSA visits to U.S. EDs in 2008 by the homeless resulted in a stay of greater than six hours*. However, this was not the highest proportion of boarding by all subgroups tested in this research study; rather, it was determined that 48.4% of all MHSA visits by patients identifying as multiple race, and 40.6% by Asians (vs. 19.2 for non-Hispanic Whites), resulted in boarding. These disparities for MHSA patients appear alarmingly high and underscore a need for future research, practice and policy initiatives to help understand and address them.

Finally, there were unanticipated results for this research question that merit discussion. First was the finding of no difference between the dichotomized group of insured and uninsured patients with respect to proportion of visits resulting in patient boarding. This finding is encouraging and suggests that our nation's EDs do not discriminate based on a patient's insurance status. Second was the finding that as the percentage of adults with a Bachelor's degree or higher in a patient's ZIP code increased, so did the proportion of ED visits resulting in boarding. The author is at a loss to explain this difference, and it may warrant further research, though the difference observed was small (9.8% for the category with lowest percent with a Bachelor's degree vs. 12.5% for the category with the highest).

Research Question Three: For those patients who board in U.S. EDs, how long does the average patient board, and does this time vary by patient type, or by hospital, patient and community characteristics? In answering this research question, boarding time was defined as time spent in the ED in excess of six hours. Given that this first six hours was not included in the mean patient boarding time, results demonstrate that patients who boarded in U.S. EDs in 2008 had considerable lengths of stay. For example, the average boarding patient experienced 216.2 minutes of boarding, or a total ED length of stay of over nine and a half hours. For the MHSA subpopulation, the average boarding patient had 292.7 minutes of boarding, or almost eleven total hours in the ED. To put these times into perspective, the United Kingdom's National Health Service has a policy that no ED patient should wait longer than four hours from arrival to admission, transfer or discharge (NHS, 2000), and it achieved 96% compliance with this mandate in 2004 (Alberti, 2004). In light of such a comparison, the figures produced by this study appear discouraging to say the least.

The analysis of differences in mean patient boarding times by region demonstrated that the Northeast region boarded the MHSA subpopulation for significantly longer than other regions, at 381.3 minutes on average. The importance of this result is compounded by the finding that the Northeast also boarded a significantly greater proportion of MHSA patients than other regions, with 30.6% of all MHSA related visits resulting in boarding. In other words, roughly one in three MHSA related visits in the Northeast resulted in ED stays of approximately 12.5 hours; this figure seems unacceptably high and warrants further attention.

Another noteworthy result in the analysis of this research question was the fact that government non-federal EDs boarded MHSA patients for significantly longer (389.4 minutes) than both voluntary non-profit (265.1 minutes) and proprietary hospitals (277.3 minutes). While this finding was not surprising, the magnitude of the difference was unexpectedly high. Combined with the finding that government non-federal EDs also boarded a significantly higher proportion of MHSA patients than other types of EDs (29.6% of all MHSA related visits), these figures stand out even more, and indicate a need for targeted efforts for this population.

One result was particularly encouraging: the finding that transfer patients in EDs located in non-metropolitan statistical areas (non-MSAs) boarded for significantly less time (101.9 minutes) than their counterparts in MSAs (267.1 minutes). This was reinforced by the finding that mean patient boarding times for transfer patients with non-metropolitan/micropolitan ZIP codes were only about one-third of that for patients with metropolitan ZIP codes (79.4 minutes vs. 224.7 minutes). These results may indicate that our nation’s rural hospitals are efficient and adept at arranging transfers.

However, the finding that the dichotomized group of insured transfer boarders had significantly shorter boarding times than the uninsured group of transferred boarders (193.0 minutes vs. 341.1 minutes) suggests our nation's EDs experience difficulty in placing uninsured patients in transfer facilities. In a similar vein, the trend towards longer boarding times as level of poverty in the patient's ZIP code increased also indicates a discouraging association between lower income and decreased level of service in our nation's EDs. This disparity was particularly pronounced for the population of MHSA homeless, where the average boarding visit resulted in 552.6 minutes of boarding time, compared to an average of 260.2 minutes for patients living in private residences. Combined with the finding that 43.4% of all MHSA related homeless visits result in boarding, these figures are even more concerning.

Another large disparity was found between the dichotomized group of MHSA boarders based upon race/ethnicity. The group comprised of non-Hispanic White, non-Hispanic Black and Hispanic boarded on average for 281.1 minutes, whereas the group of Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, and multiple races boarded on average for 462.8 minutes. This large difference suggests that our nation's mental health services for smaller minorities are particularly lacking and in need of improvement.

Research Question Four: What is the total amount of ED boarding time in the U.S. annually? This research question was asked in order to be able to put boarding times into perspective within estimated total annual visit times to U.S. EDs. Without such a benchmark against which to measure the magnitude of the time ED patients spend boarding, it would be difficult to gauge the true scale of the problem. By viewing boarding times as a proportion of cumulative total annual ED visit times for all patients in the U.S. in 2008, the magnitude of the problem becomes quite clear.

Overall, 12.5% of all patient visit time to U.S. EDs in 2008 was spent boarding. The reader is reminded that this time does not include the first six hours these boarding patients spent in EDs, but rather this figure only represents time spent in excess of the first six hours. Stated another way, one out of every eight hours of our nation’s ED visit time was consumed by ED patient boarding in 2008. This figure appears large enough to justify the research and policy focus that has been placed on ED boarding as a contributor to emergency department crowding. Additionally, several researchers have drawn attention to the fact that boarding, in addition to being associated with negative patient outcomes, is not in the best financial interest of hospitals (Bayley et al., 2005; Falvo et al., 2007; Henneman et al., 2009; Lucas, Farley, Twanmoh, Urumov, Evans et al., 2009). While it is impossible to calculate an actual figure for the potential revenue loss for hospitals that these 49.2 million hours of boarding time represent, such a figure would undoubtedly be staggering.

Perhaps even more striking are the results of these figures for the mental health and substance abuse (MHSA) subpopulation, where 23.7% of all MHSA patient visit time to U.S. EDs in 2008 was spent boarding. Equally as striking is the wide gap between percentage of visit time and percentage of boarding time for this subpopulation: MHSA patients accounted for only 9.1% of all visit time to U.S. EDs in 2008, yet they accounted for 17.3% of all boarding time. These figures highlight the crisis our nation’s EDs are experiencing with respect to the current lack of both mental health and substance abuse services and facilities, as well as the restrictive legislation governing the treatment, transfer and discharge criteria for these patients. There are no winners in this equation; while EDs experience negative effects from this boarding, the boarded MHSA patients do not receive the level of care they deserve (ACEP, 2008; Lewin Group, 2008; Lewin Group, 2009; McGee & Kaplan, 2007; Pedroja, 2008). These results indicate the need for immediate, wide ranging and large scale interventions that include funding for MHSA facilities and services, and new policies and legislation to address this issue on a national scale.

Research Question Five: What are the relationships among patient, hospital, and community characteristics and ED boarding? The multilevel regression analyses used to answer this research question looked at only the population of boarded patients within the sample to determine predictors that were associated with boarding time. In hindsight, it would have also been useful to perform multilevel logistic regression analyses using the entire sample to determine predictors associated with whether or not a visit resulted in boarding. Future analyses should investigate those relationships.

Surprisingly, results for these multilevel multivariate analyses demonstrated relationships that were markedly different from the relationships demonstrated through the bivariate analyses used to answer research questions 1-4. Most importantly, the relationships demonstrated between mean boarding times and hospital characteristics in the bivariate analyses in research question 3 did not match the results produced by the multilevel multivariate analyses. The reason for these differences is likely because the bivariate analyses did not take the level 2 ED weights into account. Those analyses provided means for boarding time at level 1, but the categorical variables (such as region) were at level 2. Therefore, the unequal probability sampling of the hospitals within level

2 variables, such as region, were not included in the estimations. Since the multilevel analyses incorporated stratification, cluster sampling, and sampling weights at both level 1 and level 2 from this complex survey data, they are deemed more reliable than the results for the hospital characteristics from the bivariate analyses. This is an important finding and future researchers using this dataset should be aware of these differences when estimating patient level results from hospital level characteristics, e.g., patient boarding time by region.

In all models leading up to and including the final composite multilevel model, MHSA status remained a strong, significant predictor of increased boarding time. In the final model, MHSA status also had significant interaction effects with homelessness at level 1, and region at level 2. This underscores the importance of this variable that was highlighted in the bivariate analyses. Clearly, mental health and substance abuse related visits are associated with significantly longer boarding times, especially for the homeless.

The most surprising finding in the multilevel analysis was that the West region boards for significantly less time on average than all other regions. As stated above, this finding was not apparent in the bivariate analyses, which indicated that the South had the lowest mean boarding time of all regions in the sample. Again, this difference can be attributed to the capacity of multilevel statistical techniques to account for both the patient and ED levels simultaneously in a model. This finding indicates that future researchers may want to focus efforts to understand what the West as a region may be doing differently than other regions to achieve lower boarding times. However, on a much larger scale, this contrary result to what was shown in the bivariate analysis highlights the power of multilevel analysis in general and the importance in using this technique to analyze complex datasets such as the NHAMCS.

Significance

This study has several key features that add to the strength of the findings. First, the complex sample used as the data source for this study was robust enough to produce unbiased probability estimates that are generalizable to the entire population of ED visits to the U.S. in 2008. Second, while the study relied on secondary data, the breadth of the data contained in the NHAMCS, especially the availability of specific timing variables regarding patients' length of stay in the ED, afforded the ability to answer all of the research questions posed. Finally, by including a multi-stage sampling algorithm with weights at both the patient and department levels, the dataset allowed not only for bivariate analyses of patient and department level variables, but also for a multilevel multivariate regression analysis capable of estimating parameters accounting for patient and departmental weights simultaneously.

Limitations

This research study had several important limitations. Some of these limitations were the result of the lack of any previous analysis of U.S. boarding practices on the scale that this research study attempted. Such studies would have served as useful guides for the development of research questions, important variables to examine, associations to test, limitations of the dataset or certain measures, and benchmarks to measure change. A previous study of this size and scope could have provided insight into the best statistical techniques to address the research questions being posed, particularly with regard to the importance of using multilevel techniques where both patient and hospital level characteristics were involved. In the absence of such a precedent, this study broke new ground relying only on single-site academic research center studies and available documentation for such guidance. Other limitations specific to the study are discussed in greater detail below.

Lack of National Practice Definitions

The lack of national practice definitions for many of the key variables of interest was a major limitation of this study. Even the definition for the outcome variable measured in this study, boarding time, had to be selectively defined by this researcher due to the lack of any national standard. Other countries, such as the U.K. and Australia, have had clear definitions for this variable for close to a decade (Australian College for Emergency Medicine, 2002; NHS, 2000); it would be useful if national practice organizations in the U.S. could come to a consensus to follow suit in this regard. Similarly, the fact that this study included patients that were ultimately discharged directly from the ED, but that had experienced ED lengths of stay >6 hours, as boarding patients, likely resulted in overestimation of overall boarding visits. To mitigate this concern, efforts were taken to provide tables itemizing boarding patients by type: admitted boarder, transferred boarder, and discharged boarder. Again, until U.S. national practice organizations come to a consensus on explicit definitions to measure these phenomena, such variables will not be incorporated into data collection systems and instruments, and will continue to have to be constructed from less than ideal proxies.

Identifying MHSA Related Visits

This study may also be limited by the ability to accurately identify mental health and substance abuse patients within the NHAMCS dataset. As described in detail in

Chapter Three above, diligent efforts were undertaken to unequivocally identify every mental health or substance abuse related visit within the dataset. However, even following an extended algorithm that included case by case evaluations, only 6.5% of the weighted sample were identified as being MHSA related visits. While this figure is higher than the 5.4% of MHSA related visits found by Hazlett et al. (2004) based on NHAMCS data from the year 2000, it is still much lower than the more recent 12.5% of MHSA related visits found by researchers using the Nationwide Emergency Department Sample (NEDS) dataset from the year 2007 (Owens, Mutter et al., 2010). This discrepancy is likely due to differences between the variables collected in the NHAMCS and the NEDS. While the NHAMCS captures only 3 diagnoses and 3 causes of injury, the NEDS includes fields for up to 15 diagnoses and 4 causes of injury (AHRQ, 2010; CDC, 2008). Given these differences, it is likely that this study underestimated the true number of MHSA patients.

Poorly Defined/Measured Variables

While the NHAMCS is undoubtedly a useful research tool, several of the variables in the dataset were either problematically defined or poorly measured. For example, the variable for patient residence included five categories: private residence, nursing home, other institution, other residence, and homeless. However, “other residence” was literally a category for any residence not included in the other categories, defined as “The patient’s current place of residence is a hotel, college dormitory, assisted living center, etc.” (CDC, 2008, p. 124). This category undermined the usefulness of the variable, as the estimates produced from the analysis of patient residence would have been more accurate had the visit records coded as “other residence” been assigned to the category most similar to the patient's reported residence, e.g., college dormitory coded as "private residence." Likewise, it was expected that the variable for the total number of hours a hospital was on ambulance diversion in 2007 would be continuous, but for no apparent reason (and with no explanation as to the logic) this variable was converted to four categories in the dataset, with no access to the raw continuous data. While still useful, analysis of this variable as a continuous measure would have surely led to better estimates.

Theory

The conceptual framework developed by Asplin et al. (2003) proved useful as a starting point for understanding emergency department crowding and served as the basis for an adapted conceptual model for this study (see Appendix B). While the adapted conceptual model provided for the identification of several key variables for the study, the study relied solely on a secondary dataset. This dataset, the NHAMCS, did contain all of the variables of interest for the study; however, it did not afford the opportunity to construct measures conforming to ideal conceptual definitions for all variables. Rather, variables were operationally limited to their definitions and measurements available within the dataset.

Several measures theorized to be instrumental in the conceptual model proved unreliable or unavailable. For example, the variable for number of days that hospital elective surgeries were performed was intended to measure the competition between ED patients and surgical patients for inpatient beds, but all results including this variable were unreliable due to the magnitude of their standard errors. Similarly, the variable for number of times a patient had been seen in the same ED in the last 12 months was intended to be an indicator for increased demand for ED care, but all analyses including this variable were either unreliable or produced meaningless results.

In sum, the conceptual model employed for this study served as a useful starting point for a national study on ED boarding practices, but it is likely that the model would have worked more efficiently and effectively for a study in which the researcher could exercise greater control over the design and measurement of the variables. In the absence of a better option, the model proved to be adequate to meet the needs of the study.

Implications

Results of this research study have important implications for practice and policy, theory, and research. Foremost, this study has demonstrated that ED boarding is not limited to the handful of urban, academic research hospitals in which it has been shown to exist; rather it is a nationwide problem that deserves nationwide attention. While this had previously been assumed to be true, there is now quantitative evidence justifying the position statements of such major stakeholders such as Emergency Nurses Association, the American College of Emergency Physicians, and the American Academy of Emergency Medicine.

Practice/Policy

It is hoped that these professional organizations can leverage the results of this study to aid in efforts to inform policy and practice in a way that acknowledges the profound extent of boarding in our nation's EDs. Several studies have found negative patient outcomes significantly associated with either increased ED length of stay or with ED boarding (Chalfin et al., 2007; Hong et al., 2009; Liu et al., 2009; Pines et al., 2008).

Results of this study suggest these effects are likely generalizable to a much broader group of hospitals than previously studied.

At the top of the list of actions indicated by the results of this research study is the need for significant improvements in the services and facilities available to mental health and substance abuse patients entering the healthcare system through our nation’s EDs. As previously stated, from 1970 to 2003, the U.S. experienced a 62% decline in inpatient psychiatric beds per capita, and an 89% decline in state and county psychiatric hospital beds per capita (President's New Freedom Commission on Mental Health, 2003). The effects of these closures are clearly manifesting. Furthermore, researchers have concluded that the MHSA population receives substandard care while in the ED (American College of Emergency Physicians, 2008; Lewin Group, 2008; Lewin Group, 2009). These patients deserve a higher standard of care, and solutions that better meet their healthcare needs would likely also benefit our nation’s other ED visitors, and our healthcare system overall, by reducing MHSA boarding.

Almost equally important as this need for increased services and facilities is the need to lobby for and enact legislation that more accurately reflects and governs the trajectory that MHSA patients take from the time they enter the ED until admission, transfer or discharge. Instrumental in this legislation is the requirement that mental health and substance abuse facilities accept patients from our nation’s EDs once these patients have been medically cleared and deemed appropriate for transfer. Guidelines for such medical clearance should also be reviewed to ensure they are relevant to today’s U.S. healthcare environment. Lastly, laws governing involuntary commitments vary from state to state; stakeholders should work with policymakers to enact overarching national legislation that uniformly governs how these patients are committed and that streamlines their treatment.

Theory

The conceptual model by Asplin et al. (2003) and the model adapted from it served as useful guides for this study. However, as discussed in the limitations section above, many of the variables measured in the NHAMCS were too poorly defined or measured to allow for an effective fit with the model. It is hoped that future researchers will be able to draw upon the strengths and learn from the weaknesses of the model's fit with the dataset that were demonstrated by this research study.

Additionally, two variables that were available in the dataset but not explicitly mapped in the model proved to have significant associations with boarding proportion or time: region and metropolitan statistical area. While these variables are certainly measures of the healthcare system in the conceptual model adapted for the study (see Appendix B), results of this study indicate that future models should incorporate these variables more explicitly. Likewise, homelessness (by virtue of its interaction with MHSA status) proved to be a strong indicator of boarding time, and should likely feature prominently in future models. In conclusion, results of this study should be used to inform efforts at building improved models in the future, and also to select variables that effectively measure concepts within those models.

Research

This study indicates the need for future researchers to be cautious when using datasets such as the NHAMCS to estimate patient level variables from hospital level characteristics. The bivariate analyses for this study were performed following the instructions provided in the 2008 NHAMCS documentation (CDC, 2008). However, this led to different results than those produced by the multilevel multivariate analyses that were guided by techniques described by Heeringa et al. (2010) and Muthén and Muthén (2010). It is assumed that the multilevel analyses resulted in more reliable estimates as they accounted for weights at both levels 1 and 2; however, future researchers, including the administrators of the NHAMCS, should continue to examine these differences and publish their findings to help clarify the best use of such complex surveys.

Finally, this study indicates the need for more uniform crowding measures to be established on a national level. Adoption of such national practice standards for emergency department crowding would go far toward not only creating universal measures for researchers studying the phenomenon, but would also aid administrators and policymakers in their efforts to establish new guidelines and laws to manage and govern emergency department crowding. The lack of such national practice standards was a major limitation for this study. It is the hope that results from this study will not only underscore the need for adoption of such standards, but will also help shape them.

Conclusion

In summary, this study of U.S. ED boarding practices has filled an important gap in the literature and body of knowledge about ED crowding. It is the first study known to describe U.S. ED boarding practices on a national level, and has established that ED boarding is indeed a nationwide problem. This finding corroborates and validates the results of previous studies done on much smaller scales, and goes far toward expanding the generalizability of the findings of previous researchers.

Equally as important, this study has demonstrated that mental health related visits are consistently associated with both a higher proportion of boarding and longer boarding times, indicative of a growing crisis in our nation's capacity to serve mental health patients. While this study has demonstrated manifestations of this crisis within our nation's EDs, many of the solutions to this crisis likely lie beyond these EDs, and even beyond the hospitals and communities they serve. This study has indicated the need for increased facilities and services, and improved legislation and policies geared toward the mental health population and the broader systems that regulate and manage mental health care. It is hoped that this study will serve as a useful benchmark and reference for future researchers to build upon in the efforts to establish persuasive, evidence based arguments about ED crowding that can improve the quality and safety of emergency care in our nation's healthcare system.

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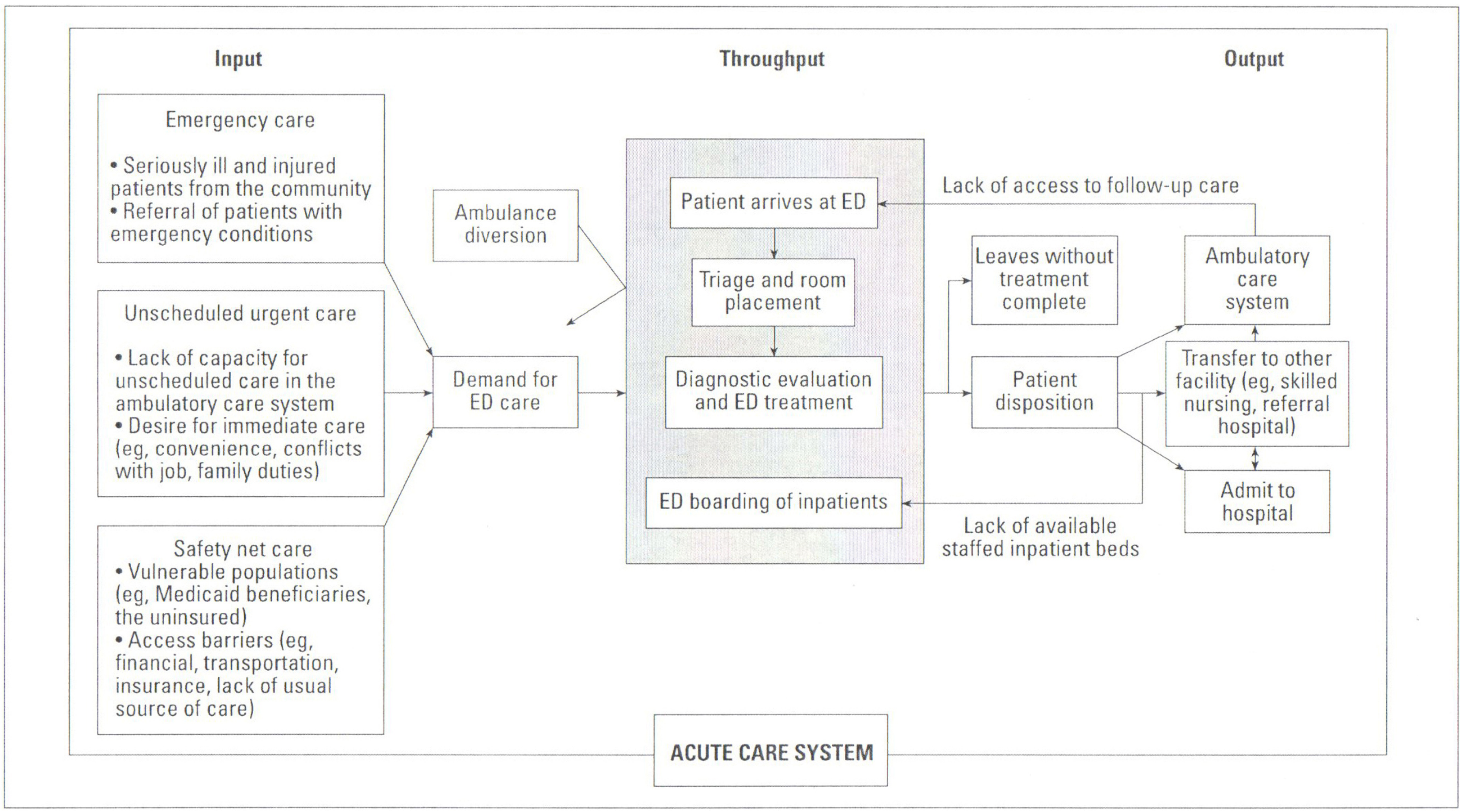
Appendix A

Figure 1. *The input-throughput-output conceptual model of ED crowding (Asplin et al., 2003).*



Appendix B

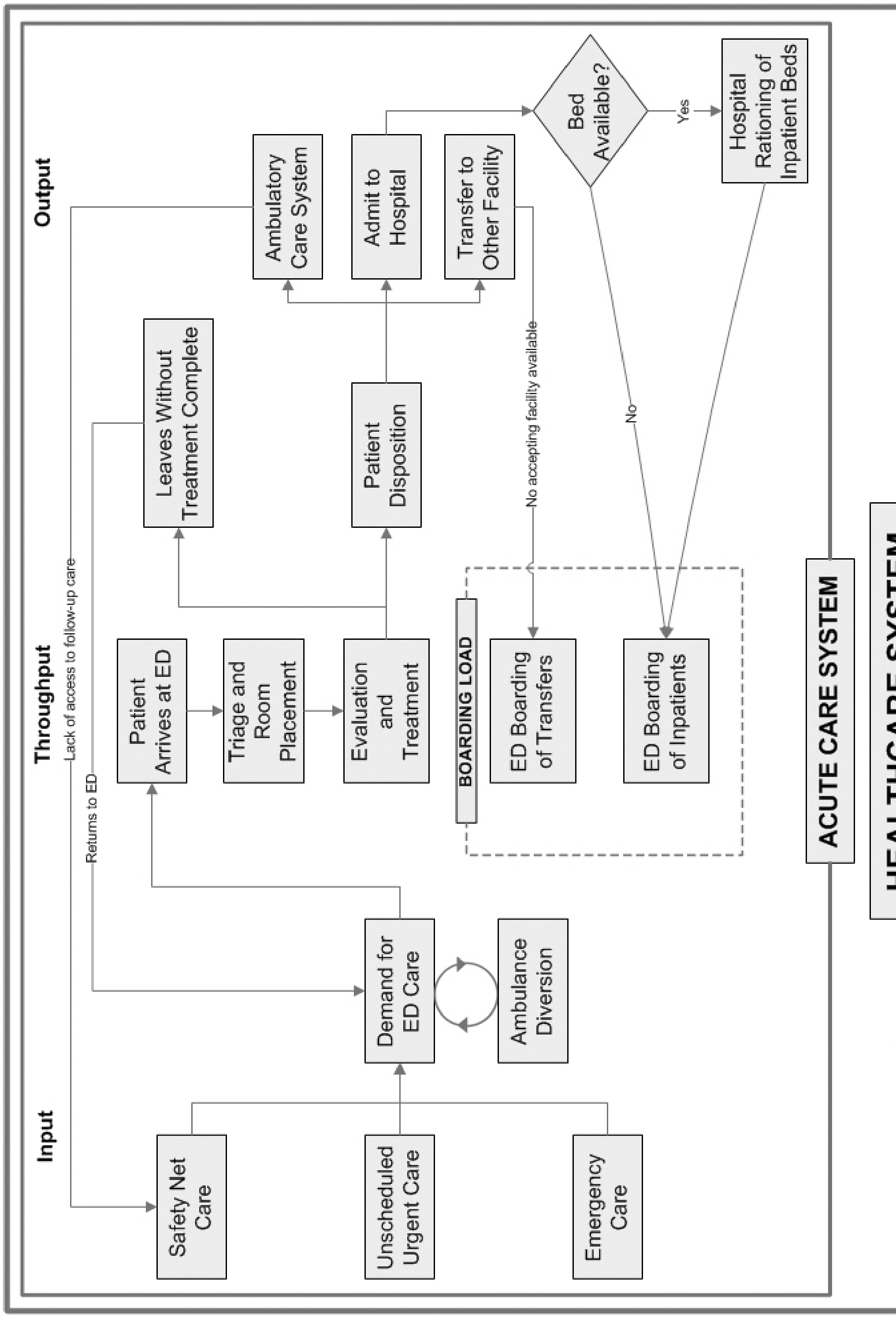


Figure 2. *The adapted conceptual framework of EDC.*

Appendix C

Emergency Department Work Index (EDWIN)

$$\text{EDWIN} = \frac{\Sigma\, n_i t_i}{N_a(B_T - B_A)}$$

Where: n_i = number of patients in the ED in the triage category i

t_i = triage category (ordinal scale 1-5, 5 being most acute)

N_a = the number of attending physicians on duty

B_T = number of treatment beds in the ED

B_A = number of admitted patients boarding in the ED

Appendix D

National Emergency Department Overcrowding Scale (NEDOCS)

NEDOCS = $((P_{bed}/B_t) \times 85.8) + ((P_{admit}/B_h) \times 600) + (W_{time} \times 5.64) +$

$(A_{time} \times 0.93) + ((R_n \times 13.4) - 20)$

Where: P_{bed} = number of patients in ED beds

B_t = number of ED beds

P_{admit} = number of admitted patients

B_h = number of hospital beds

W_{time} = waiting room time for last patient placed into an ED bed

A_{time} = longest time since registration among boarding admitted patients

R_n = number of respirators in use in the ED

Appendix E

Occupancy Level

Occupancy Level = 100 x (P_{bed}/B_t)

Where: P_{bed} = number of patients in licensed beds and overflow locations, such as hallway beds or chairs

B_t = number of licensed treatment beds

Appendix F

Form Approved OMB No. 0920-0278 Exp. Date 08/31/2009 CDC 64.136

FORM **NHAMCS-100(ED)**
(10-2-2007)

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU
ACTING AS DATA COLLECTION AGENT FOR THE
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Center for Health Statistics

PATIENT RECORD NO.:

PATIENT'S NAME:

NATIONAL HOSPITAL AMBULATORY MEDICAL CARE SURVEY
2008 EMERGENCY DEPARTMENT PATIENT RECORD

Assurance of confidentiality – All information which would permit identification of an individual, a practice, or an establishment will be held confidential, will be used only by persons engaged in and for the purpose of the survey and will not be disclosed or released to other persons or used for any other purpose without consent of the individual or the establishment in accordance with section 308(d) of the Public Health Service Act (42 USC 242m).

(Provider: Detach and keep)

Please keep (X) marks inside of boxes ➜ ☒ Correct ☒ Incorrect

1. PATIENT INFORMATION

a. Date of visit — Month / Day / Year: 2 0 0 _

b. ZIP Code

c. Date of birth — Month / Day / Year

d. Time of day
(1) Arrival ☐ AM ☐ PM ☐ Military
(2) Time seen by physician ☐ AM ☐ PM ☐ Military
☐ Not seen by physician
(3) ED discharge ☐ AM ☐ PM ☐ Military
Mark (X) if ED discharge is more than 24 hours from arrival. ☐

e. Patient residence
1 ☐ Private residence
2 ☐ Nursing home
3 ☐ Other institution
4 ☐ Other residence
5 ☐ Homeless
6 ☐ Unknown

f. Sex
1 ☐ Female
2 ☐ Male

g. Ethnicity
1 ☐ Hispanic or Latino
2 ☐ Not Hispanic or Latino

h. Race – *Mark (X) one or more.*
1 ☐ White
2 ☐ Black/African American
3 ☐ Asian
4 ☐ Native Hawaiian/Other Pacific Islander
5 ☐ American Indian/Alaska Native

i. Mode of arrival – *Mark (X) one.*
1 ☐ Ambulance
2 ☐ Public service (nonambulance)
3 ☐ Personal transportation
4 ☐ Unknown

j. Expected source(s) of payment for this visit – *Mark (X) all that apply.*
1 ☐ Private insurance
2 ☐ Medicare
3 ☐ Medicaid/SCHIP
4 ☐ Worker's compensation
5 ☐ Self-pay
6 ☐ No charge/Charity
7 ☐ Other
8 ☐ Unknown

2. TRIAGE

a. Initial vital signs
(1) Temperature ☐ °C ☐ °F
(2) Heart rate ___ per minute
(3) Respiratory rate ___ per minute
(4) Blood pressure — Systolic / Diastolic
(5) Pulse oximetry ___ %
(6) Oriented X 3 — 1 ☐ Yes 2 ☐ No 3 ☐ Unknown

b. Immediacy with which patient should be seen
1 ☐ Immediate
2 ☐ 1-14 minutes
3 ☐ 15-60 minutes
4 ☐ >1 hour-2 hours
5 ☐ >2 hours-24 hours
6 ☐ No triage
7 ☐ Unknown

c. Presenting level of pain
1 ☐ None
2 ☐ Mild
3 ☐ Moderate
4 ☐ Severe
5 ☐ Unknown

3. PREVIOUS CARE

a. Has patient been –

	Yes	No	Unknown
(1) seen in this ED within the last 72 hours?	1 ☐	2 ☐	3 ☐
(2) discharged from any hospital within the last 7 days?	1 ☐	2 ☐	3 ☐

b. How many times has patient been seen in this ED within the last 12 months? ___ 3 ☐

4. REASON FOR VISIT

a. Patient's complaint(s), symptom(s), or other reason(s) for this visit *Use patient's own words.*
(1) Most important:
(2) Other:
(3) Other:

b. Episode of care
1 ☐ Initial visit for problem
2 ☐ Follow-up visit for problem
3 ☐ Unknown

5. INJURY/POISONING/ADVERSE EFFECT

a. Is this visit related to an injury, poisoning, or adverse effect of medical treatment?
1 ☐ Yes
2 ☐ No – *SKIP to item 6.*

b. Is this injury/poisoning intentional?
1 ☐ Yes, self inflicted
2 ☐ Yes, assault
3 ☐ No, unintentional
4 ☐ Unknown

c. Cause of injury, poisoning, or adverse effect – *Describe the place and events that preceded the injury, poisoning, or adverse effect (e.g., allergy to penicillin, bee sting, pedestrian hit by car driven by drunk driver, spouse beaten with fists by spouse, heroin overdose, infected shunt, etc.).*

6. PROVIDER'S DIAGNOSIS FOR THIS VISIT

As specifically as possible, list diagnoses related to this visit including chronic conditions.
(1) Primary diagnosis:
(2) Other:
(3) Other:

7. DIAGNOSTIC/SCREENING SERVICES

*Mark (X) all **ordered** or **provided** at this visit.*
1 ☐ NONE
Blood tests:
2 ☐ CBC
3 ☐ BUN/Creatinine
4 ☐ Cardiac enzymes
5 ☐ Electrolytes
6 ☐ Glucose
7 ☐ Liver function tests
8 ☐ Arterial blood gases
9 ☐ Prothrombin time/INR
10 ☐ Blood culture
11 ☐ BAC (blood alcohol)
12 ☐ Toxicology screen
13 ☐ Other blood test
Other tests:
14 ☐ Cardiac monitor
15 ☐ EKG/ECG
16 ☐ Pregnancy test
17 ☐ Rapid flu/Influenza test
18 ☐ Urinalysis (UA)
19 ☐ Wound culture
20 ☐ Other test/service
Imaging:
21 ☐ X-ray
22 ☐ CT scan
☐ Head
☐ Other than head
23 ☐ MRI
☐ Head
☐ Other than head
24 ☐ Ultrasound
25 ☐ Other imaging

8. PROCEDURES

*Mark (X) all **provided** at this visit. Exclude medications.*
1 ☐ NONE
2 ☐ IV fluids
3 ☐ Cast
4 ☐ Splint or wrap
5 ☐ Laceration repair
6 ☐ Incision & drainage (I&D)
7 ☐ Wound debridement
8 ☐ Foreign body removal
9 ☐ Nebulizer therapy
10 ☐ Bladder catheter
11 ☐ NG tube/gastric suction
12 ☐ CPR
13 ☐ Endotracheal intubation
14 ☐ Other

9. MEDICATIONS & IMMUNIZATIONS

List up to 8 drugs given at this visit or prescribed at ED discharge. Include Rx and OTC drugs, immunizations, and anesthetics.
☐ NONE

	Given in ED	Rx at discharge
(1)	1 ☐	2 ☐
(2)	1 ☐	2 ☐
(3)	1 ☐	2 ☐
(4)	1 ☐	2 ☐
(5)	1 ☐	2 ☐
(6)	1 ☐	2 ☐
(7)	1 ☐	2 ☐
(8)	1 ☐	2 ☐

10. PROVIDERS

Mark (X) all providers seen at this visit.
1 ☐ ED attending physician
2 ☐ ED resident/Intern
3 ☐ On call attending physician/Fellow/Resident
4 ☐ RN/LPN
5 ☐ Nurse practitioner
6 ☐ Physician assistant
7 ☐ EMT
8 ☐ Other

11. VISIT DISPOSITION

Mark (X) all that apply.
1 ☐ No follow-up planned
2 ☐ Return if needed, PRN/appointment
3 ☐ Return/Refer to physician/clinic for FU
4 ☐ Refer to social services
5 ☐ Left before medical screening exam
6 ☐ Left after medical screening exam
7 ☐ Left AMA
8 ☐ DOA
9 ☐ Died in ED
10 ☐ Transfer to different hospital - *Specify reason*
11 ☐ Admit to observation unit
12 ☐ Admit to hospital – *Please continue with* ***Item 12 - HOSPITAL ADMISSION*** *on the reverse side.*
13 ☐ Other

12. HOSPITAL ADMISSION

Complete if the patient was admitted to the hospital at this visit. – *Mark (X) "Data not available" in each item, if efforts have been exhausted to collect the data.*

a. Admitted to:

1 ☐ Critical care unit
2 ☐ Stepdown or telemetry unit
3 ☐ Operating room
4 ☐ Cardiac catheterization lab
5 ☐ Mental health or detox unit
6 ☐ Other bed/unit
7 ☐ Data not available

b. Hospital admission date

Month		Day		Year			
				2	0	0	

1 ☐ Data not available

c. Hospital admission time

☐ ☐ : ☐ ☐ ☐ AM ☐ PM ☐ Military

1 ☐ Data not available

d. Hospital discharge date

Month		Day		Year			
				2	0	0	

1 ☐ Data not available

e. Principal hospital discharge diagnosis

____

1 ☐ Data not available

f. Hospital discharge status/disposition

1 ☐ Alive → 1 ☐ Home/Residence, 2 ☐ Transferred, 3 ☐ Other, 4 ☐ Data not available
2 ☐ Dead
3 ☐ Unknown
4 ☐ Data not available

If this information is not available at time of abstraction, then complete the Hospital Admission Log.

Appendix G

650 Adjustment disorders
3090 3091 30922 30923 30924 30928 30929 3093 3094 30982 30983
30989 3099

651 Anxiety disorders
29384 30000 30001 30002 30009 30010 30020 30021 30022 30023 30029
3003 3005 30089 3009 3080 3081 3082 3083 3084 3089 30981
3130 3131 31321 31322 3133 31382 31383

652 Attention-deficit, conduct, and disruptive behavior disorders
31200 31201 31202 31203 31210 31211 31212 31213 31220 31221 31222
31223 3124 3128 31281 31282 31289 3129 31381 31400 31401 3141
3142 3148 3149

653 Delirium, dementia, and amnestic and other cognitive disorders
2900 29010 29011 29012 29013 29020 29021 2903 29040 29041 29042
29043 2908 2909 2930 2931 2940 2941 29410 29411 2948 2949
3100 3102 3108 3109 3310 3311 33111 33119 3312 33182 797

654 Developmental disorders
3070 3079 31500 31501 31502 31509 3151 3152 31531 31532 31534
31535 31539 3154 3155 3158 3159 317 3180 3181 3182 319 V400 V401

655 Disorders usually diagnosed in infancy, childhood, or adolescence
29900 29901 29910 29911 29980 29981 29990 29991 30720 30721 30722
30723 3073 3076 3077 30921 31323 31389 3139

656 Impulse control disorders, NEC
31230 31231 31232 31233 31234 31235 31239

657 Mood disorders
29383 29600 29601 29602 29603 29604 29605 29606 29610 29611 29612
29613 29614 29615 29616 29620 29621 29622 29623 29624 29625 29626
29630 29631 29632 29633 29634 29635 29636 29640 29641 29642 29643
29644 29645 29646 29650 29651 29652 29653 29654 29655 29656 29660
29661 29662 29663 29664 29665 29666 2967 29680 29681 29682 29689
29690 29699 3004 311

658 Personality disorders
3010 30110 30111 30112 30113 30120 30121 30122 3013 3014 30150
30151 30159 3016 3017 30181 30182 30183 30184 30189 3019

659 Schizophrenia and other psychotic disorders
29381 29382 29500 29501 29502 29503 29504 29505 29510 29511 29512
29513 29514 29515 29520 29521 29522 29523 29524 29525 29530 29531
29532 29533 29534 29535 29540 29541 29542 29543 29544 29545 29550
29551 29552 29553 29554 29555 29560 29561 29562 29563 29564 29565
29570 29571 29572 29573 29574 29575 29580 29581 29582 29583 29584
29585 29590 29591 29592 29593 29594 29595 2970 2971 2972 2973
2978 2979 2980 2981 2982 2983 2984 2988 2989

660 Alcohol-related disorders
2910 2911 2912 2913 2914 2915 2918 29181 29182 29189 2919 30300 30301 30302 30303 30390 30391 30392 30393 30500 30501 30502 30503 76071 9800

661 Substance-related disorders
2920 29211 29212 2922 29281 29282 29283 29284 29285 29289 2929 30400 30401 30402 30403 30410 30411 30412 30413 30420 30421 30422 30423 30430 30431 30432 30433 30440 30441 30442 30443 30450 30451 30452 30453 30460 30461 30462 30463 30470 30471 30472 30473 30480 30481 30482 30483 30490 30491 30492 30493 30520 30521 30522 30523 30530 30531 30532 30533 30540 30541 30542 30543 30550 30551 30552 30553 30560 30561 30562 30563 30570 30571 30572 30573 30580 30581 30582 30583 30590 30591 30592 30593 64830 64831 64832 64833 64834 65550 65551 65553 76072 76073 76075 7795 96500 96501 96502 96509 V6542

662 Suicide and intentional self-inflicted injury
E9500 E9501 E9502 E9503 E9504 E9505 E9506 E9507 E9508 E9509 E9510 E9511 E9518 E9520 E9521 E9528 E9529 E9530 E9531 E9538 E9539 E954 E9550 E9551 E9552 E9553 E9554 E9555 E9556 E9557 E9559 E956 E9570 E9571 E9572 E9579 E9580 E9581 E9582 E9583 E9584 E9585 E9586 E9587 E9588 E9589 E959 V6284

663 Screening and history of mental health and substance abuse codes
3051 30510 30511 30512 30513 33392 3575 4255 5353 53530 53531 5710 5711 5712 5713 7903 V110 V111 V112 V113 V114 V118 V119 V154 V1541 V1542 V1549 V1582 V6285 V663 V701 V702 V7101 V7102 V7109 V790 V791 V792 V793 V798 V799

670 Miscellaneous disorders
29389 2939 30011 30012 30013 30014 30015 30016 30019 3006 3007 30081 30082 3021 3022 3023 3024 30250 30251 30252 30253 3026 30270 30271 30272 30273 30274 30275 30276 30279 30281 30282 30283 30284 30285 30289 3029 3060 3061 3062 3063 3064 30650 30651 30652 30653 30659 3066 3067 3068 3069 3071 30740 30741 30742 30743 30744 30745 30746 30747 30748 30749 30750 30751 30752 30753 30754 30759 30780 30781 30789 3101 316 64840 64841 64842 64843 64844 V402 V403 V409 V673

Appendix H

Additional Diagnoses		Additional Causes of Injury
290	967	935
291	968	937
292	969	936
293	970	938
294	971	939
295	972	940
296	973	941
297	974	942
298	975	943
299	976	944
300	977	945
301	978	946
302	979	947
303	980	950
304	981	951
305	982	952
306	983	953
307	984	954
308	985	955
309	986	956
310	987	957
311	988	958
312	989	959
313		980
314		981
315		982
316		983
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797		
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Appendix I

UCSF
University of California
San Francisco

Human Research Protection Program
Committee on Human Research

Notification of Denial of Requested Review

Date: February 14, 2011

Principal Investigator
Mary A Blegen

Co-Principal Investigator
Jason Nolan

Study Title: Measuring United States Emergency Department Boarding Practices
Study #: 11-05576
Reference #: 017625

Review of your recent submission on the above named protocol was denied by the CHR because this study:

_____ does not qualify as research,

___X__ does not qualify as human subjects,

_____ the UCSF CHR will not serve as the IRB of record for this research, and/or

_____ other (see comments below).

Comments:
Because the application proposes to only access de-identified datasets, this study does not constitute human subject research.

If you need documentation for funding agencies, administrators, or collaborators, a Self-Certification Form is provided for your use. Copies of this form should be maintained in your research files. Do **not** submit a copy of the form to the CHR.

If you have any questions, or need additional information, please contact the CHR office at 415-476-1814.

Appendix J

Table J1. *Proportion of ED Visits Resulting in Boarding by Type and Region*

Visit Type	Northeast (95% CI) (N)	Midwest (95% CI) (N)	South (95% CI) (N)	West (95% CI) (N)	Design-based Pearson
All Visit Types	14.6% (12.3-17.3) (3,589,476)	10.3% (7.7-13.7) (2,789,300)	9.7% (8.1-11.5) (4,653,151)	10.9% (8.6-13.8) (2,624,561)	$F_{2.8, 496}$=3.17 p=0.03
Admitted Only	5.9% (4.3-8.0) (1,444,230)	4.3% (3.1-6.2) (1,170,604)	2.9% (2.2-3.8) (1,402,885)	3.6% (3.4-4.6) (873,630)	$F_{2.9, 500.4}$=4.39 p=0.005
Transferred Only	0.34% (0.18-0.65) (83,434)	0.28% (0.13-0.60) (75,900)	0.57% (0.43-0.78) (276,765)	0.40% (0.25-0.62) (95,492)	$F_{2.8, 488.1}$=1.77 p=0.16
Discharged Only	8.4% (7.2-9.9) (2,065,194)	5.7% (4.3-7.6) (1,548,882)	6.2% (5.2-7.3) (2,973,501)	6.9% (5.2-9.0) (1,655,439)	$F_{2.8, 490.7}$=2.19 p=0.09

Table J2. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Region*

Visit Type	Northeast (95% CI) (N)	Midwest (95% CI) (N)	South (95% CI) (N)	West (95% CI) (N)	Design-based Pearson
All Visit Types	30.6% (25.3-36.4) (476,041)	19.3% (12.7-28.0) (336,196)	19.9% (16.2-24.3) (556,442)	18.8% (14.9-23.5) (376,849)	$F_{2.5, 442.8}$=3.39 p=0.02
Admitted Only	9.0% (5.5-14.4) (140,473)	6.8% (4.1-11.2) (119,364)	4.4% (2.9-6.7) (122,570)	3.7% (2.2-6.1) (73,507)	$F_{2.9, 506.2}$=2.88 p=0.04
Transferred Only	4.6% (2.4-8.7) (71,423)	2.6%* (1.0-6.5) (45,780)	6.2% (4.3-8.8) (173,276)	3.1%* (1.6-5.8) (61,688)	$F_{2.9, 509.6}$=1.79 p=0.15
Discharged Only	17.1% (13.3-21.8) (266,156)	9.8% (6.5-14.6) (171,052)	9.3% (7.1-12.2) (260,596)	12.1% (8.3-17.3) (241,654)	$F_{2.9, 502.7}$=3.09 p=0.03

*Unreliable: standard error >30% of estimate

Table J3. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Region*

Visit Type	Northeast (95% CI) (N)	Midwest (95% CI) (N)	South (95% CI) (N)	West (95% CI) (N)	Design-based Pearson
All Visit Types	13.6% (11.2-16.3) (3,113,435)	9.7% (7.3-12.9) (2,453,104)	9.0% (7.5-10.8) (4,096,709)	10.2% (7.8-13.2) (2,247,712)	$F_{2.9, 507.2}$=2.73 p=0.045

Admitted Only	5.7% (4.1-7.8) (1,303,757)	4.2% (2.9-5.9) (1,051,240)	2.8% (2.2-3.7) (1,280,315)	3.6% (2.7-4.9) (800,123)	$F_{2.9, 504.4}$=4.03 p=0.008
Transferred Only	.052% (.026-.11) (12,011)	.12% (.054-.26) (30,120)	.23% (.14-.37) (103,489)	.15% (.088-.27) (33,804)	$F_{2.56, 447.4}$=3.25 p=0.03
Discharged Only	7.8% (6.7-9.2) (1,799,038)	5.5% (4.1-7.3) (1,377,830)	6.0% (5.0-7.1) (2,712,905)	6.4% (4.8-8.6) (1,413,785)	$F_{2.8, 490.3}$=1.70 p=0.17

Table J4. *Proportion of ED Visits Resulting in Boarding by Type and MSA Status*

Visit Type	MSA (95% CI) (N)	Non-MSA (95% CI) (N)	Design-based Pearson
All Visit Types	12.3% (11.1-13.6) (12,733,921)	4.6% (3.0-7.1) (922,567)	$F_{1, 175}$=20.0 p<.0005
Admitted Only	4.4% (3.7-5.1) (4,550,858)	1.7%* (.77-3.8) (340,491)	$F_{1, 175}$=5.46 p=0.02
Transferred Only	0.41% (0.31-0.54) (423,872)	0.54% (0.33-0.89) (107,719)	$F_{1, 175}$=0.87 p=0.35
Discharged Only	7.5% (6.8-8.3) (7,762,573)	2.4% (1.6-3.6) (480,443)	$F_{1, 175}$=34.0 p<.0005

*Unreliable: standard error >30% of estimate

Table J5. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and MSA Status*

Visit Type	MSA (95% CI) (N)	Non-MSA (95% CI) (N)	Design-based Pearson
All Visit Types	23.8% (21.1-26.7) (1,647,848)	8.4% (5.2-13.2) (97,680)	$F_{1, 175}$=22.0 p<.0005
Admitted Only	6.6% (5.2-8.3) (455,914)	0% (0.0-0.0) (0)	$F_{1, 175}$=2.96 p=0.09
Transferred Only	4.1% (3.0-5.8) (286,662)	5.6% (3.4-9.2) (65,505)	$F_{1, 175}$=0.90 p=0.34

Discharged Only	13.1% (11.2-15.3) (907,283)	2.8%* (1.2-6.0) (32,175)	$F_{1, 175}$=18.6 p<.0005

*Unreliable: standard error >30% of estimate

Table J6. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and MSA Status*

Visit Type	MSA (95% CI) (N)	Non-MSA (95% CI) (N)	Design-based Pearson
All Visit Types	11.4% (10.3-12.7) (11,086,073)	4.4% (2.7-7.0) (824,887)	$F_{1, 175}$=16.5 p=0.0001
Admitted Only	4.2% (3.6-4.8) (4,094,994)	1.8%* (.82-4.0) (340,491)	$F_{1, 175}$=4.36 p=0.04
Transferred Only	.14% (.10-.20) (137,210)	.22%* (.10-.53) (42,214)	$F_{1, 175}$=0.96 p=0.33
Discharged Only	7.1% (6.4-7.9) (6,855,290)	2.4% (1.6-3.6) (448,268)	$F_{1, 175}$=29.8 p<.0005

*Unreliable: standard error >30% of estimate

Table J7. *Proportion of ED Visits Resulting in Boarding by Type and Ownership*

Visit Type	Voluntary Non-Profit (95% CI) (N)	Government Non-Federal (95% CI) (N)	Proprietary (95% CI) (N)	Design-based Pearson
All Visit Types	11.3% (10.1-12.6) (10,732,902)	14.4% (10.8-19.0) (2,028,619)	6.1% (4.3-8.7) (894,967)	$F_{1.9, 333.8}$=6.9 p=0.0015
Admitted Only	4.3% (3.7-5.1) (4,097,097)	4.1% (2.6-6.2) (570,004)	1.5%* (.82-2.8) (224,248)	$F_{1.9, 331.7}$=5.0 p=0.008
Transferred Only	.46% (.35-.61) (439,579)	.37% (.23-.59) (51,386)	.28%* (.14-.53) (40,626)	$F_{1.82, 318.5}$=1.42 p=0.24
Discharged Only	6.5% (5.8-7.3) (6,202,312)	10.0% (7.5-13.3) (1,410,611)	4.3% (3.0-6.1) (630,093)	$F_{1.9, 337}$=7.6 p=.0007

*Unreliable: standard error >30% of estimate

Table J8. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Ownership*

Visit Type	Voluntary Non-Profit (95% CI) (N)	Government Non-Federal (95% CI) (N)	Proprietary (95% CI) (N)	Design-based Pearson
All Visit Types	21.0% (18.1-24.3) (1,255,376)	29.6% (23.4-36.6) (375,469)	13.4% (8.0-21.6) (114,683)	$F_{1.97, 344}$=5.3 p=0.0057
Admitted Only	5.3% (3.9-7.3) (319,092)	10.0% (6.9-14.2) (126,429)	1.2%* (.33-4.4) (10,393)	$F_{1.95, 341.3}$=7.3 p=0.0009
Transferred Only	5.0 % (3.7-6.7) (299,511)	2.9% (1.7-5.0) (37,173)	1.8%* (.58-5.5) (15,483)	$F_{1.82, 318.5}$=1.42 p=0.24
Discharged Only	10.7% (8.7-13.0) (636,773)	16.9% (12.9-21.8) (213,878)	10.4%* (5.4-19.1) (88,807)	$F_{1.8, 317.3}$=2.7 p=.07

*Unreliable: standard error >30% of estimate

Table J9. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Ownership*

Visit Type	Voluntary Non-Profit (95% CI) (N)	Government Non-Federal (95% CI) (N)	Proprietary (95% CI) (N)	Design-based Pearson
All Visit Types	10.6% (9.5-11.9) (9,477,526)	12.9% (9.5-17.4) (1,653,150)	5.7% (3.9-8.1) (780,284)	$F_{1.9, 332.7}$=5.8 p=0.004
Admitted Only	4.2% (3.6-5.0) (3,778,005)	3.5% (2.2-5.6) (443,757)	1.6%* (.83-2.9) (213,855)	$F_{1.9, 330.5}$=5.0 p=0.009
Transferred Only	.16 % (.10-.24) (140,068)	.11% * (.06-.22) (14,213)	.18%* (.09-.36) (25,143)	$F_{1.74, 304.9}$=0.34 p=0.68
Discharged Only	6.3% (5.6-7.0) (5,565,539)	9.4% (6.8-12.7) (1,196,733)	3.9% (2.7-5.6) (541,286)	$F_{1.9, 331.4}$=6.8 p=.0016

*Unreliable: standard error >30% of estimate

Table J10. *Proportion of ED Visits Resulting in Boarding by Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007*

Visit Type	0 Hours (95% CI) (N)	1-99 Hours (95% CI) (N)	100-499 Hours (95% CI) (N)	≥500 Hours (95% CI) (N)	Design-based Pearson
All Visit Types	7.2% (5.9-8.9) (3,337,450)	9.6% (7.2-12.7) (1,963,403)	14.2% (11.5-17.5) (2,501,864)	17.4% (14.8-20.4) (3,025,074)	$F_{3.9, 680.3}$=11.5 p<0.0005
Admitted Only	2.3% (1.7-3.1) (1,065,059)	3.3% (2.2-5.0) (683,133)	5.0% (3.7-6.9) (885,802)	7.4% (5.6-9.8) (1,291,392)	$F_{3.9, 675.9}$=9.0 p<0.0005
Transferred Only	.34% (.22-.52) (158,397)	.42% (.25-.71) (86,165)	.43% (.24-.78) (75,417)	.47% (.29-.76) (81,401)	$F_{3.76, 658.4}$=0.78 p=0.53
Discharged Only	7.8% (6.7-9.2) (2,120,080)	5.5% (4.1-7.3) (1,194,105)	6.0% (5.0-7.1) (1,540,645)	6.4% (4.8-8.6) (1,652,281)	$F_{3.8, 671.0}$=7.7 p<0.0005

Table J11. *Proportion of MHSA Related ED Visits Resulting in Boarding by Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007*

Visit Type	0 Hours (95% CI) (N)	1-99 Hours (95% CI) (N)	100-499 Hours (95% CI) (N)	≥500 Hours (95% CI) (N)	Design-based Pearson
All Visit Types	11.3% (8.5-14.8) (303,050)	22.0% (16.3-29.0) (309,320)	28.6% (22.3-35.9) (402,623)	31.3% (25.3-38.1) (384,970)	$F_{3.8, 657.1}$=8.5 p<0.0005
Admitted Only	2.2%* (.97-4.8) (58,495)	6.1% (3.7-10.1) (86,310)	6.0% (3.3-10.6) (84,491)	11.2% (7.2-17.0) (137,433)	$F_{3.9, 677.6}$=4.5 p=0.0017
Transferred Only	3.7% (2.4-5.6) (98,994)	3.8%* (2.0-6.9) (53,033)	4.7%* (2.3-9.3) (65,744)	4.1%* (2.1-8.0) (50,456)	$F_{3.67, 641.8}$=0.58 p=0.66
Discharged Only	5.4% (3.8-7.8) (145,561)	12.1% (7.9-18.0) (169,977)	17.9% (13.1-24.1) (252,388)	16.0% (11.3-22.3) (197,081)	$F_{3.8, 671.0}$=7.7 p<0.0005

*Unreliable: standard error >30% of estimate

Table J12. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007*

Visit Type	0 Hours (95% CI) (N)	1-99 Hours (95% CI) (N)	100-499 Hours (95% CI) (N)	≥500 Hours (95% CI) (N)	Design-based Pearson
All Visit Types	7.0% (5.6-8.6) (3,034,400)	8.7% (6.5-11.6) (1,654,083)	13.0% (10.2-16.4) (2,099,241)	16.4% (13.6-19.6) (2,640,104)	$F_{3.9, 689.9}$=10.0 p<0.0005

Admitted Only	2.3% (1.7-3.1) (1,006,564)	3.1% (2.1-4.8) (596,823)	5.0% (3.6-6.8) (801,311)	7.2% (5.3-9.6) (1,153,959)	$F_{3.9, 676.5}=8.3$ p<0.0005
Transferred Only	.14% * (.07-.28) (59,403)	.17%* (.09-.33) (33,132)	.06%* (.02-.22) (9,673)	.19%* (.09-.42) (30,945)	$F_{3.82, 667.7}=0.86$ p=0.48
Discharged Only	4.5% (3.6-5.7) (1,974,519)	5.4% (4.0-7.3) (1,024,128)	8.0% (6.3-10.0) (1,288,257)	9.0% (7.2-11.3) (1,455,200)	$F_{3.9, 685.2}=6.4$ p=0.0001

*Unreliable: standard error >30% of estimate

Table J13. *Proportion of ED Visits Resulting in Boarding by Type and Safety Net Status*

Visit Type	Safety Net (95% CI) (N)	Non-Safety Net (95% CI) (N)	Design-based Pearson
All Visit Types	10.8% (9.3-12.5) (6,354,760)	11.2% (9.7-12.9) (7,158,398)	$F_{1, 173}=0.13$ p=0.72
Admitted Only	3.2% (2.5-4.1) (1,873,403)	4.7% (3.9-5.7) (2,997,108)	$F_{1, 173}=6.1$ p=0.015
Transferred Only	.47% (.33-.66) (274,591)	.40% (.29-.55) (257,000)	$F_{1, 173}=0.40$ p=0.53
Discharged Only	7.2% (6.1-8.4) (4,210,148)	6.1% (5.3-7.0) (3,910,376)	$F_{1, 173}=2.245$ p=0.14

Table J14. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Safety Net Status*

Visit Type	Safety Net (95% CI) (N)	Non-Safety Net (95% CI) (N)	Design-based Pearson
All Visit Types	23.3% (19.7-27.3) (957,672)	19.8% (16.2-23.9) (787,856)	$F_{1, 175}=1.6$ p=0.20
Admitted Only	5.2% (3.5-7.7) (215,050)	6.0% (4.3-8.4) (240,864)	$F_{1, 175}=0.28$ p=0.60
Transferred Only	5.0% (3.4-7.2) (204,710)	3.7% (2.5-5.5) (147,457)	$F_{1, 175}=1.13$ p=0.29
Discharged Only	13.1% (10.4-16.4) (539,923)	10.0% (8.1-12.4) (399,535)	$F_{1, 175}=3.03$ p=0.08

Table J15. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Safety Net Status*

Visit Type	Safety Net (95% CI) (N)	Non-Safety Net (95% CI) (N)	Design-based Pearson
All Visit Types	9.9% (8.4-11.6) (5,397,088)	10.6% (9.2-12.3) (6,370,542)	$F_{1, 174}$=0.50 p=0.48
Admitted Only	3.0% (2.4-3.9) (1,658,353)	4.6% (3.8-5.6) (2,756,244)	$F_{1, 174}$=6.8 p=0.0099
Transferred Only	.13% (.07-.24) (69,881)	.18%* (.12-.27) (109,543)	$F_{1, 174}$=0.83 p=0.36
Discharged Only	6.7% (5.7-7.9) (3,670,225)	5.9% (5.1-6.7) (3,510,841)	$F_{1, 174}$=1.58 p=0.21

*Unreliable: standard error >30% of estimate

Table J16. *Proportion of ED Visits Resulting in Boarding by Type and Age*

Visit Type	<15 yr (95% CI) (N)	15-24 yr (95% CI) (N)	25-44 yr (95% CI) (N)	45-64 yr (95% CI) (N)	65-74 yr (95% CI) (N)	75+ yr (95% CI) (N)	Design-based Pearson
All Visit Types	3.6% (2.8-4.7) (839,601)	7.9% (6.8-9.1) (1,561,135)	10.8% (9.5-12.2) (3,796,258)	15.3% (13.4-17.3) (4,016,670)	16.0% (13.6-18.7) (1,195,255)	19.1% (16.6-21.8) (2,247,569)	$F_{4.5, 778}$=73.9 p<0.0001
Admitted Only	.7% (.5-1.2) (169,063)	1.0% (.7-1.5) (200,642)	2.7% (2.2-3.2) (934,881)	6.0% (4.9-7.2) (1,556,404)	8.8% (7.1-11.0) (659,001)	11.6% (9.7-13.9) (1,371,358)	$F_{4.3, 760}$=115.3 p<0.0001
Transferred Only	.12%* (.06-.22) (27,301)	.64% (.42-.97) (126,448)	.33%* (.22-.50) (115,207)	.67% (.48-.95) (177,259)	.45%* (.20-.97) (33,287)	.44%* (.22-.89) (52,089)	$F_{4.6, 797}$=5.1 p=0.0002
Discharged Only	2.8% (2.1-3.7) (643,237)	6.2% (5.3-7.4) (1,234,045)	7.8% (6.9-8.9) (2,747,350)	8.7% (7.6-9.9) (2,283,838)	6.7% (5.3-8.6) (502,967)	7.1% (5.8-8.5) (831,579)	$F_{4.1, 724}$=21.1 p<0.0001

*Unreliable: standard error >30% of estimate

Table J17. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Age*

Visit Type	<15 yr (95% CI) (N)	15-24 yr (95% CI) (N)	25-44 yr (95% CI) (N)	45-64 yr (95% CI) (N)	65-74 yr (95% CI) (N)	75+ yr (95% CI) (N)	Design-based Pearson
All Visit Types	15.2% (9.7-23.2) (52,582)	20.3% (16.1-25.3) (308,488)	20.5% (16.9-24.6) (632,119)	23.9% (19.9-28.4) (559,893)	24.6% (14.6-38.3) (69,669)	23.1% (16.2-31.8) (122,776)	$F_{4.8, 782}$=0.9 p=0.45
Admitted Only	.97%* (.13-6.8) (3,339)	2.8%* (1.5-5.5) (42,943)	5.3% (3.5-8.0) (163,553)	5.4% (3.7-7.7) (125,631)	14.7% (8.2-24.7) (41,576)	14.8% (8.7-24.2) (78,872)	$F_{4.7, 826}$=7.0 p<0.0001

Transferred Only	4.0%* (1.5-10.6) (13,947)	7.1% (4.4-11.1) (106,924)	3.4% (2.2-5.3) (106,189)	4.8% (3.4-6.9) (112,859)	2.6%* (.4-14.9) (7,460)	.9%* (.3-2.9) (4,788)	$F_{4.0, 704}$=2.5 p=0.04
Discharged Only	10.2% (5.8-17.5) (35,297)	10.5% (7.2-15.0) (158,621)	11.8% (9.2-15.0) (363,557)	13.8% (10.4-18.0) (322,234)	7.3%* (3.3-15.3) (20,633)	7.4%* (3.8-13.7) (39,116)	$F_{4.5, 788}$=1.2 p=0.32

*Unreliable: standard error >30% of estimate

Table J18. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Age*

Visit Type	<15 yr (95% CI) (N)	15-24 yr (95% CI) (N)	25-44 yr (95% CI) (N)	45-64 yr (95% CI) (N)	65-74 yr (95% CI) (N)	75+ yr (95% CI) (N)	Design-based Pearson
All Visit Types	3.5% (2.7-4.4) (787,018)	6.9% (5.8-8.0) (1,252,647)	9.9% (8.7-11.2) (3,164,139)	14.4% (12.6-16.4) (3,456,777)	15.6% (13.2-18.5) (1,125,586)	18.9% (16.4-21.6) (2,124,793)	$F_{4.4, 765}$=78.7 p<0.0001
Admitted Only	.73% (.47-1.1) (165,724)	.86% (.58-1.3) (157,699)	2.4% (1.9-3.0) (771,328)	6.0% (4.9-7.3) (1,430,773)	8.6% (6.9-10.7) (617,425)	11.5% (9.6-13.7) (1,292,486)	$F_{4.5, 781}$=113.3 p<0.0001
Transferred Only	No reliable estimates available*						
Discharged Only	2.7% (2.0-3.6) (607,940)	5.9% (5.0-7.0) (1,075,424)	7.4% (6.4-8.5) (2,383,793)	8.2% (7.2-9.2) (1,961,604)	6.7% (5.2-8.6) (482,334)	7.0% (5.8-8.5) (792,463)	$F_{4.1, 716}$=20.3 p<0.0001

*Unreliable: standard error >30% of estimate

Table J19. *Proportion of ED Visits Resulting in Boarding by Type and Residence*

Visit Type	Private Residence (95% CI) (N)	Nursing Home (95% CI) (N)	Other Institution (95% CI) (N)	Other Residence (95% CI) (N)	Homeless (95% CI) (N)	Design-based Pearson
All Visit Types	10.4% (9.3-11.6) (11,791,262)	23.1% (18.8-28.0) (578,643)	17.2% (12.4-23.5) (164,154)	13.1% (9.2-18.5) (120,607)	28.4% (20.3-38.2) (154,596)	$F_{3.8, 666}$=29.2 p<0.0001
Admitted Only	3.5% (3.0-4.2) (4,010,626)	15.2% (11.4-20.0) (380,397)	6.5% (4.1-10.2) (62,078)	5.0%* (2.6-9.2) (45,515)	6.7%* (3.6-12.1) (36,248)	$F_{3.6, 619}$=48.6 p<0.0001
Transferred Only	No reliable estimates available*					
Discharged Only	6.4% (5.8-7.2) (7,295,087)	7.5% (5.1-10.8) (187,085)	10.0% (6.2-15.8) (95,400)	7.8% (5.0-11.8) (71,366)	21.3% (14.1-30.9) (116,231)	$F_{3.6, 610}$=9.5 p<0.0001

*Unreliable: standard error >30% of estimate

Table J20. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Residence*

Visit Type	Private Residence (95% CI) (N)	Nursing Home (95% CI) (N)	Other Institution (95% CI) (N)	Other Residence (95% CI) (N)	Homeless (95% CI) (N)	Design-based Pearson
All Visit Types	20.5% (17.8-23.4) (1,390,168)	27.5% (16.1-42.8) (68,398)	23.3% (12.5-39.4) (42,859)	11.6%* (5.1-24.2) (19,684)	43.4% (29.3-58.7) (94,230)	$F_{3.6, 629}$=4.1 p=0.004
Admitted Only	4.7% (3.4-6.4) (315,989)	20.6%* (9.9-37.8) (51,185)	10.1%* (4.2-22.6) (18,622)	3.9%* (1.0-14.4) (6,663)	13.2%* (6.7-24.3) (28,717)	$F_{3.4, 589}$=7.9 p<0.0001
Transferred Only	4.7% (3.5-6.3) (319,989)	3.2%* (1.3-7.9) (7,971)	3.6%* (.7-15.5) (6,676)	1.5%* (.5-4.8) (2,520)	1.0%* (.3-3.2) (2,117)	$F_{2.9, 499}$=1.5 p=0.20
Discharged Only	11.1% (9.3-13.3) (756,201)	3.7%* (1.4-9.4) (9,242)	9.6%* (4.2-20.2) (17,561)	6.2%* (2.5-14.4) (10,501)	29.2% (18.0-43.6) (63,396)	$F_{3.6, 622}$=7.4 p<0.0001

*Unreliable: standard error >30% of estimate

Table J21. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Residence*

Visit Type	Private Residence (95% CI) (N)	Nursing Home (95% CI) (N)	Other Institution (95% CI) (N)	Other Residence (95% CI) (N)	Homeless (95% CI) (N)	Design-based Pearson
All Visit Types	9.8% (8.7-11.0) (10,401,094)	22.6% (18.0-28.0) (510,245)	15.8% (11.0-22.1) (121,295)	13.5% (9.1-19.5) (100,923)	18.4% (10.7-29.9) (60,366)	$F_{3.7, 636}$=22.3 p<0.0001
Admitted Only	3.5% (2.9-4.1) (3,694,637)	14.6% (10.7-19.6) (329,212)	5.6% (3.2-9.7) (43,456)	5.2%* (2.5-10.3) (38,852)	2.3%* (.4-12.4) (7,531)	$F_{3.6, 630}$=35.9 p<0.0001
Transferred Only	No reliable estimates available*					
Discharged Only	6.1% (5.5-6.9) (6,538,886)	7.9% (5.4-11.4) (177,843)	10.1% (5.8-17.0) (77,839)	8.1% (5.2-12.6) (60,865)	16.1% (8.9-27.5) (52,835)	$F_{3.6, 619}$=4.1 p=0.004

*Unreliable: standard error >30% of estimate

Table J22. *Proportion of ED Visits Resulting in Boarding by Type and Gender*

Visit Type	Female (95% CI) (N)	Male (95% CI) (N)	Design-based Pearson
All Visit Types	12.0% (10.8-13.4) (8,058,404)	9.9% (8.8-11.0) (5,598,084)	$F_{1, 175}$=22.0 p<0.0001

Admitted Only	4.1% (3.4-4.9) (2,739,876)	3.8% (3.2-4.5) (2,151,473)	$F_{1, 175}=1.1$ p=0.29
Transferred Only	.39% (.28-.54) (260,542)	.48% (.35-.65) (271,049)	$F_{1, 175}=0.94$ p=0.33
Discharged Only	7.6% (6.7-8.5) (5,059,911)	5.6% (5.0-6.3) (3,183,105)	$F_{1, 175}=33.8$ p<0.0001

Table J23. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Gender*

Visit Type	Female (95% CI) (N)	Male (95% CI) (N)	Design-based Pearson
All Visit Types	21.9% (18.3-25.8) (862,406)	21.3% (18.4-25.0) (883,122)	$F_{1, 175}=0.07$ p=0.79
Admitted Only	7.0% (5.0-9.7) (275,033)	4.4% (3.2-6.0) (180,881)	$F_{1, 175}=4.5$ p=0.04
Transferred Only	5.0% (3.4-7.3) (196,680)	3.7% (2.5-5.6) (155,487)	$F_{1, 175}=1.0$ p=0.31
Discharged Only	9.9% (7.8-12.5) (391,247)	13.2% (10.9-15.9) (548,211)	$F_{1, 175}=4.3$ p=0.04

Table J24. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Gender*

Visit Type	Female (95% CI) (N)	Male (95% CI) (N)	Design-based Pearson
All Visit Types	11.4% (10.2-12.8) (7,195,998)	9.0% (8.0-10.1) (4,714,962)	$F_{1, 175}=29.9$ p<0.0001
Admitted Only	3.9% (3.3-4.7) (2,464,843)	3.8% (3.2-4.4) (1,970,592)	$F_{1, 175}=0.33$ p=0.57
Transferred Only	No reliable estimates available*		
Discharged Only	7.4% (6.6-8.3) (4,668,664)	5.0% (4.4-5.7) (2,634,894)	$F_{1, 175}=57.7$ p<0.0001

*Unreliable: standard error >30% of estimate

Table J25. *Proportion of ED Visits Resulting in Boarding by Type and Race/Ethnicity*

Visit Type	Non-Hispanic White (95% CI) (N)	Non-Hispanic Black (95% CI) (N)	Hispanic (95% CI) (N)	Asian (95% CI) (N)	Native Hawaiian/ Pacific Islander (95% CI) (N)	American Indian/ Alaska Native (95% CI) (N)	Multiple Races (95% CI) (N)	Design-based Pearson
All Visit Types	10.5% (9.3-11.8) (7,933,592)	12.3% (10.3-14.6) (3,328,001)	11.3% (9.3-13.7) (1,786,596)	12.4% (9.4-16.1) (304,482)	9.9% (6.5-14.7) (69,377)	7.3% (4.3-12.3) (73,571)	15.3% (9.5-23.5) (160,869)	$F_{4.2, 736}$=1.6 p=0.18
Admitted Only	4.1% (3.4-4.9) (3,105,907)	4.0% (3.1-5.3) (1,092,302)	3.2% (2.4-4.3) (506,315)	4.9% (3.0-8.0) (121,430)	4.0%* (2.0-8.0) (28,269)	2.4%* (.9-6.5) (24,136)	1.2%* (.6-2.7) (1,042,053)	$F_{4.3, 756}$=1.3 p=0.29
Transferred Only	.44% (.33-.58) (332,982)	.49% (.32-.75) (132,324)	.34% (.18-.62) (53,139)	.34%* (.14-.82) (8,349)	No data	No data	.45%* (.01-2.0) (4,797)	$F_{2.2, 383}$=0.2 p=0.9
Discharged Only	6.0% (5.3-6.7) (4,502,437)	7.8% (6.6-9.1) (2,103,652)	7.8% (6.2-9.7) (1,227,419)	7.2% (5.3-9.6) (175,883)	5.9% (3.3-10.3) (41,108)	4.9%* (2.7-8.9) (49,435)	13.6% (7.8-22.6) (143,082)	$F_{4.7, 830}$=4.5 p=0.0007

*Unreliable: standard error >30% of estimate

Table J26. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Race/Ethnicity*

Visit Type	Non-Hispanic White (95% CI) (N)	Non-Hispanic Black (95% CI) (N)	Hispanic (95% CI) (N)	Asian (95% CI) (N)	Native Hawaiian/ Pacific Islander (95% CI) (N)	American Indian/ Alaska Native (95% CI) (N)	Multiple Races (95% CI) (N)	Design-based Pearson
All Visit Types	19.2% (16.2-22.6) (998,016)	24.1% (18.6-30.7) (371,633)	25.7% (20.2-32.1) (265,249)	40.6% (22.4-61.9) (59,693)	14.3%* (3.3-44.9) (3,732)	7.7%* (1.0-40.3) (5,852)	48.4% (31.3-65.8) (41,353)	$F_{5.0, 873}$=3.6 p=0.0034
Admitted Only	4.6% (3.2-6.7) (240,574)	6.6% (4.3-9.9) (101,718)	7.4%* (3.9-13.7) (76,459)	20.7%* (7.8-44.6) (30,398)	4.5%* (1.8-11.0) (1,175)	2.1%* (.3-13.2) (1,578)	4.7%* (.9-21.8) (4,012)	$F_{4.0, 691}$=3.1 p=0.0167
Transferred Only	4.2% (3.0-5.9) (219,488)	5.4% (3.4-8.5) (83,187)	3.6%* (1.8-7.0) (36,991)	5.2%* (2.1-12.8) (7,704)	No data	No data	5.6%* (1.3-21.6) (4,797)	$F_{4.4, 771}$=0.35 p=0.86
Discharged Only	10.4% (8.2-13.0) (538,231)	12.1% (9.0-16.2) (187,005)	14.8% (10.1-21.1) (152,076)	15.5%* (6.6-32.3) (22,771)	9.8%* (1.0-55.0) (2,557)	5.6%* (.8-31.5) (4,274)	38.1% (27.2-50.3) (32,544)	$F_{5.1, 886}$=3.1 p=0.008

*Unreliable: standard error >30% of estimate

Table J27. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Race/Ethnicity*

Visit Type	Non-Hispanic White (95% CI) (N)	Non-Hispanic Black (95% CI) (N)	Hispanic (95% CI) (N)	Asian (95% CI) (N)	Native Hawaiian/ Pacific Islander (95% CI) (N)	American Indian/ Alaska Native (95% CI) (N)	Multiple Races (95% CI) (N)	Design-based Pearson
All Visit Types	9.9% (8.7-11.2) (6,935,576)	11.6% (9.6-13.8) (2,956,368)	10.3% (8.3-12.7) (1,521,347)	10.6% (7.9-14.1) (244,789)	9.7% (6.3-14.8) (65,645)	7.3%* (4.3-12.1) (67,719)	12.3%* (6.2-23.0) (119,516)	$F_{4.4, 761}$=1.1 p=0.38

Admitted Only	4.1% (3.4-4.9) (2,865,333)	3.9% (2.9-5.1) (990,584)	2.9% (2.1-3.9) (429,856)	3.9% (2.3-6.7) (91,032)	4.0%* (1.9-8.1) (27,094)	2.4%* (.8-6.9) (22,558)	.9%* (.4-2.2) (8,978)	$F_{4.2, 741}$=1.5 p=0.18
Transferred Only	.16% (.10-.26) (113,494)	.19% (.10-.38) (49,137)	.11% (.04-.31) (16,148)	.03% (.004-.21) (645)	No data	No data	No data	$F_{2.3, 396}$=0.06 p=0.96
Discharged Only	5.6% (5.0-6.4) (3,964,206)	7.5% (6.4-8.8) (1,916,647)	7.3% (5.7-9.2) (1,075,343)	6.6% (4.8-9.1) (153,112)	5.7%* (3.1-10.3) (38,551)	4.9%* (2.7-8.7) (45,161)	11.4%* (5.3-22.8) (110,538)	$F_{4.5, 790}$=3.3 p=0.0073

*Unreliable: standard error >30% of estimate

Table J28. *Proportion of ED Visits Resulting in Boarding by Type and Expected Source of Payment*

Visit Type	Private Insurance (95% CI) (N)	Medicare (95% CI) (N)	Medicaid (95% CI) (N)	Worker's Comp (95% CI) (N)	Self-Pay (95% CI) (N)	No Charge (95% CI) (N)	Other (95% CI) (N)	Design-based Pearson
All Visit Types	9.9% (8.8-11.4) (4,284,646)	17.9% (15.6-20.4) (4,084,021)	8.8% (7.6-10.3) (2,253,626)	2.8%* (1.4-5.7) (38,504)	8.2% (6.8-9.8) (1,477,897)	16.1% (10.9-23.1) (220,714)	10.6% (7.1-15.4) (450,328)	$F_{5.0, 867}$=24.2 p<0.0001
Admitted Only	2.9% (2.4-3.6) (1,260,494)	10.0% (8.3-12.0) (2,288,690)	2.6% (2.0-3.4) (663,616)	.72%* (.20-.2.7) (9,791)	1.3% (.89-1.8) (226,352)	2.4%* (.85-6.7) (33,231)	3.8% (2.2-6.4) (159,922)	$F_{5.4, 936}$=57.2 p<0.0001
Transferred Only	.39% (.25-.60) (166,549)	.75% (.53-1.1) (171,212)	.32% (.22-.46) (81,583)	No data	.35% (.20-.63) (63,546)	.44%* (.05-3.5) (6,039)	.23%* (.08-.72) (9,882)	$F_{4.6, 793}$=2.4 p=0.04
Discharged Only	6.7% (5.8-7.7) (2,857,603)	7.2% (6.1-8.3) (1,631,576)	5.9% (5.0-7.0) (1,510,161)	2.1%* (.88-4.9) (28,713)	6.6% (5.5-7.9) (1,187,999)	13.2% (9.4-18.3) (181,444)	6.6% (4.5-9.7) (280,801)	$F_{5.3, 911}$=3.6 p=0.003

*Unreliable: standard error >30% of estimate

Table J29. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Expected Source of Payment*

Visit Type	Private Insurance (95% CI) (N)	Medicare (95% CI) (N)	Medicaid (95% CI) (N)	Worker's Comp (95% CI) (N)	Self-Pay (95% CI) (N)	No Charge (95% CI) (N)	Other (95% CI) (N)	Design-based Pearson
All Visit Types	21.6% (16.7-27.2) (495,082)	24.4% (19.7-29.7) (353,267)	21.6% (16.7-27.4) (353,748)	No data	19.0% (15.0-23.8) (300,315)	30.2% (18.8-44.5) (55,096)	13.7%* (7.0-25.0) (42,108)	$F_{5.2, 910}$=1.2 p=0.32
Admitted Only	3.5% (1.9-6.3) (79,680)	10.7% (7.5-15.2) (155,632)	7.5% (4.7-11.9) (123,453)	No data	2.6% (1.5-4.7) (41,289)	.83%* (.14-4.6) (1,509)	4.0%* (1.4-11.4) (12,343)	$F_{4.9, 855}$=5.4 p=0.0001
Transferred Only	4.3%* (2.3-7.9) (98,836)	5.5% (3.3-9.1) (80,014)	4.8% (3.2-7.1) (78,553)	No data	3.8% (2.1-6.6) (59,933)	3.3%* (.39-22.8) (6,039)	2.9%* (.82-9.6) (8,827)	$F_{4.7, 820}$=0.29 p=0.91
Discharged Only	13.8% (10.2-18.6) (316,566)	8.1% (5.6-11.6) (117,621)	9.4% (6.6-13.2) (153,476)	No data	12.6% (9.6-16.3) (199,093)	26.0% (16.4-38.7) (47,548)	6.9%* (2.6-17.2) (21,215)	$F_{5.3, 926}$=3.0 p=0.01

*Unreliable: standard error >30% of estimate

Table J30. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Expected Source of Payment*

Visit Type	Private Insurance (95% CI) (N)	Medicare (95% CI) (N)	Medicaid (95% CI) (N)	Worker's Comp (95% CI) (N)	Self-Pay (95% CI) (N)	No Charge (95% CI) (N)	Other (95% CI) (N)	Design-based Pearson
All Visit Types	9.3% (8.1-10.8) (3,789,564)	17.5% (15.1-20.1) (3,730,754)	8.0% (6.8-9.3) (1,899,878)	2.9%* (1.4-5.8) (38,504)	7.2% (5.8-8.8) (1,177,582)	13.9% (8.7-21.6) (165,618)	10.3% (6.5-16.0) (408,220)	$F_{4.7, 820}$=23.4 p<0.0001
Admitted Only	2.9% (2.4-3.6) (1,180,814)	10.0% (8.3-12.0) (2,133,058)	2.3% (1.7-3.0) (540,163)	.72%* (.19-2.7) (9,791)	1.1% (.78-1.6) (185,063)	2.7%* (.88-7.8) (31,722)	3.7%* (2.1-6.7) (147,579)	$F_{5.3, 924}$=53.0 p<0.0001
Transferred Only	.17% (.01-.28) (67,713)	.43% (.26-.69) (91,198)	.01%* (.002-.08) (3,030)	No data	.02%* (.006-.09) (3,613)	No data	.03%* (.004-.20) (1,055)	$F_{1.5, 259}$=1.9 p=0.16
Discharged Only	6.3% (5.4-7.2) (2,541,037)	7.1% (6.1-8.3) (1,513,955)	5.7% (4.8-6.8) (1,356,685)	2.1%* (.89-5.0) (28,713)	6.0% (4.9-7.4) (988,906)	11.3% (7.2-17.3) (133,896)	6.6% (4.2-10.1) (259,586)	$F_{5.3, 922}$=2.6 p=0.02

*Unreliable: standard error >30% of estimate

Table J31. *Proportion of ED Visits Resulting in Boarding by Type and Frequency of ED Use*

Visit Type	0 Visits (95% CI) (N)	1 Visit (95% CI) (N)	2 Visits (95% CI) (N)	3 Visits (95% CI) (N)	4 Visits (95% CI) (N)	5-9 Visits (95% CI) (N)	>10 Visits (95% CI) (N)	Design-based Pearson
All Visit Types	10.8% (9.4-12.4) (3,568,219)	13.1% (11.1-15.3) (2,408,156)	13.4% (11.2-15.9) (1,125,689)	11.8% (9.5-14.6) (509,008)	14.2% (10.7-18.8) (379,771)	11.7% (9.2-14.7) (514,447)	14.9% (11.4-19.2) (304,921)	$F_{4.7, 705}$=2.3 p=0.0457
Admitted Only	3.7% (3.1-4.5) (1,226,271)	5.1% (3.9-6.8) (945,913)	5.9% (4.4-7.8) (492,470)	4.5% (2.9-6.8) (193,646)	4.8% (3.0-7.7) (128,234)	4.8% (3.5-6.8) (213,023)	3.8% (2.4-5.8) (77,443)	$F_{4.1, 624}$=2.3 p=0.0538
Transferred Only	.52% (.34-.78) (170,216)	.36% (.21-.62) (65,626)	.20%* (.09-.46) (17,195)	.90%* (.32-2.5) (38,931)	.54%* (.13-2.1) (14,362)	.23%* (.09-.65) (10,323)	.87%* (.33-2.3) (17,921)	$F_{4.4, 668}$=1.5 p=0.19
Discharged Only	6.6% (5.6-7.8) (2,177,872)	7.6% (6.4-9.0) (1,397,520)	7.3% (6.0-8.9) (616,301)	6.4% (4.9-8.3) (277,262)	8.9% (6.8-11.6) (237,175)	6.6% (5.1-8.7) (292,472)	10.2% (6.9-14.9) (209,557)	$F_{5.0, 755}$=1.7 p=0.13

*Unreliable: standard error >30% of estimate

Table J32. *Proportion of MHSA Related ED Visits Resulting in Boarding by Type and Frequency of ED Use*

Visit Type	0 Visits (95% CI) (N)	1 Visit (95% CI) (N)	2 Visits (95% CI) (N)	3 Visits (95% CI) (N)	4 Visits (95% CI) (N)	5-9 Visits (95% CI) (N)	>10 Visits (95% CI) (N)	Design-based Pearson
All Visit Types	23.3% (18.5-28.9) (494,175)	31.5% (24.8-39.2) (302,474)	17.5% (11.9-25.1) (113,667)	17.8% (9.9-30.1) (53,846)	27.8% (18.2-39.9) (55,055)	20.9% (13.9-30.2) (76,517)	33.4% (21.1-48.4) (81,469)	$F_{5.2, 918}$=2.2 p=0.046
Admitted Only	6.2% (3.9-9.9) (131,720)	10.9% (6.3-18.2) (104,477)	5.4%* (2.3-11.1) (35,290)	5.9%* (2.5-13.4) (17,770)	4.8%* (1.4-15.1) (9,502)	6.3%* (2.4-15.6) (22,985)	3.8%* (1.0-14.1) (9,372)	$F_{5.5, 969}$=1.1 p=0.36
Transferred Only	No reliable estimates available*							
Discharged Only	12.7% (9.7-16.5) (269,906)	15.2% (9.8-22.9) (145,918)	10.6% (6.2-17.6) (69,089)	4.0%* (1.8-8.9) (11,989)	16.6% (9.4-27.8) (32,935)	13.0% (7.8-20.1) (47,552)	22.8%* (11.8-39.5) (55,694)	$F_{4.9, 851}$=1.8 p=0.11

*Unreliable: standard error >30% of estimate

Table J33. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Type and Frequency of ED Use*

Visit Type	0 Visits (95% CI) (N)	1 Visit (95% CI) (N)	2 Visits (95% CI) (N)	3 Visits (95% CI) (N)	4 Visits (95% CI) (N)	5-9 Visits (95% CI) (N)	>10 Visits (95% CI) (N)	Design-based Pearson
All Visit Types	10.0% (8.7-11.4) (3,074,044)	12.1% (10.2-14.2) (2,105,682)	13.0% (10.8-15.7) (1,012,022)	11.3% (9.0-14.1) (455,162)	13.1% (9.6-17.8) (324,766)	10.9% (8.3-14.1) (437,930)	12.4% (8.9-16.9) (223,452)	$F_{4.7, 815}$=2.2 p=0.0583
Admitted Only	3.6% (2.9-4.3) (1,094,497)	4.8% (3.7-6.3) (841,436)	5.9% (4.3-7.9) (457,180)	4.4% (2.8-6.8) (175,876)	4.8% (2.9-8.0) (118,732)	4.7% (3.3-6.7) (190,083)	3.8% (2.3-6.1) (68,071)	$F_{4.3, 740}$=2.4 p=0.0468
Transferred Only	No reliable estimates available*							
Discharged Only	6.2% (5.2-7.4) (1,907,966)	7.2% (6.0-8.6) (1,251,602)	7.1% (5.8-8.6) (547,212)	6.6% (5.0-8.7) (265,273)	8.3% (6.0-11.2) (204,240)	6.1% (4.4-8.2) (244,920)	8.5% (5.4-13.2) (153,863)	$F_{5.1, 889}$=1.1 p=0.38

*Unreliable: standard error >30% of estimate

Table J34. *Proportion of ED Visits Resulting in Boarding by Level of Poverty in Patient's ZIP Code*

Visit Type	<5.0% (95% CI) (N)	5.0-9.9% (95% CI) (N)	10.0-19.9% (95% CI) (N)	≥20% (95% CI) (N)	Design-based Pearson
All Visit Types	10.8% (9.0-12.9) (1,955,186)	11.2% (9.9-12.7) (3,576,167)	9.9% (8.6-11.5) (4,111,228)	12.1% (10.2-14.3) (2,887,148)	$F_{2.7, 466}$=1.8 p=0.16
Admitted Only	4.0% (3.0-5.5) (728,586)	4.5% (3.8-5.4) (1,442,670)	3.5% (2.9-4.3) (1,457,718)	4.0% (3.0-5.2) (941,520)	$F_{2.8, 476}$=1.3 p=0.28
Transferred Only	.26% (.13-.51) (47,271)	.37% (.22-.61) (117,969)	.52% (.38-.72) (214,758)	.45% (.30-.68) (107,220)	$F_{2.8, 484}$=1.4 p=0.23
Discharged Only	6.5% (5.6-7.6) (1,179,329)	6.3% (5.4-7.4) (2,023,262)	5.9% (5.0-7.0) (2,439,583)	7.7% (6.6-9.1) (1,839,311)	$F_{2.8, 477}$=2.6 p=0.057

Table J35. *Proportion of MHSA Related ED Visits Resulting in Boarding by Level of Poverty in Patient's ZIP Code*

Visit Type	<5.0% (95% CI) (N)	5.0-9.9% (95% CI) (N)	10.0-19.9% (95% CI) (N)	≥20% (95% CI) (N)	Design-based Pearson
All Visit Types	20.6% (15.0-27.6) (222,771)	20.3% (16.1-25.3) (441,537)	19.0% (15.0-23.8) (486,855)	24.9% (20.2-30.3) (404,415)	$F_{3.0, 519}$=1.1 p=0.35
Admitted Only	7.1% (3.9-12.6) (76,930)	5.5% (3.4-8.7) (119,329)	3.8% (2.5-5.9) (97,351)	8.1% (5.1-12.6) (131,244)	$F_{2.9, 503}$=2.0 p=0.12

Transferred Only	2.9%* (1.1-7.3) (31,407)	3.9%* (2.1-7.1) (84,543)	4.9% (3.3-7.2) (125,931)	4.6% (2.8-7.6) (75,179)	$F_{2.9, 500}$=0.47 p=0.69
Discharged Only	10.6% (6.8-16.1) (114,434)	11.0% (8.1-14.7) (237,942)	10.3% (7.5-14.1) (264,404)	12.3% (9.3-15.9) (198,895)	$F_{2.9, 514}$=0.23 p=0.87

*Unreliable: standard error >30% of estimate

Table J36. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Level of Poverty in Patient's ZIP Code*

Visit Type	<5.0% (95% CI) (N)	5.0-9.9% (95% CI) (N)	10.0-19.9% (95% CI) (N)	≥20% (95% CI) (N)	Design-based Pearson
All Visit Types	10.2% (8.5-12.2) (1,732,415)	10.5% (9.2-12.0) (3,134,630)	9.3% (8.0-10.9) (3,624,373)	11.2% (9.4-13.3) (2,482,733)	$F_{2.8, 483}$=1.4 p=0.26
Admitted Only	3.8% (2.8-5.2) (651,656)	4.4% (3.7-5.3) (1,323,341)	3.5% (2.9-4.3) (1,360,367)	3.7% (2.7-4.9) (810,276)	$F_{2.8, 489}$=1.3 p=0.29
Transferred Only	.09%* (.04-.24) (15,864)	.11% (.06-.21) (33,426)	.23% (.13-.39) (88,827)	.14% (.07-.30) (32,041)	$F_{2.9, 505}$=1.7 p=0.16
Discharged Only	6.3% (5.3-7.4) (1,064,895)	6.0% (5.1-7.0) (1,785,320)	5.6% (4.7-6.7) (2,175,179)	7.4% (6.2-8.7) (1,640,416)	$F_{2.8, 486}$=2.7 p=0.051

*Unreliable: standard error >30% of estimate

Table J37. *Proportion of ED Visits Resulting in Boarding by Median Household Income in Patient's ZIP Code*

Visit Type	≤$32,793 (95% CI) (N)	$32,794-$40,626 (95% CI) (N)	$40,627-$52,387 (95% CI) (N)	≥$52,388 (95% CI) (N)	Design-based Pearson
All Visit Types	10.0% (8.4-11.9) (3,543,344)	9.9% (8.3-11.8) (2,894,919)	11.7% (10.1-13.5) (3,157,926)	12.4% (10.8-14.2) (2,934,242)	$F_{2.7, 458}$=2.5 p=0.07
Admitted Only	3.3% (2.6-4.3) (1,184,815)	3.8% (3.0-4.8) (1,104,328)	4.4% (3.5-5.7) (1,194,254)	4.6% (3.7-5.7) (1,087,097)	$F_{2.8, 472}$=2.0 p=0.12
Transferred Only	.52% (.36-.74) (182,556)	.42% (.26-.66) (121,764)	.41% (.25-.66) (109,769)	.31% (.19-.51) (73,129)	$F_{3.0, 512}$=0.86 p=0.46
Discharged Only	6.1% (5.1-7.4) (2,176,876)	5.7% (4.8-6.9) (1,669,381)	6.9% (5.9-8.1) (1,860,266)	7.5% (6.4-8.8) (1,775,664)	$F_{2.8, 476}$=2.2 p=0.09

Table J38. *Proportion of MHSA Related ED Visits Resulting in Boarding by Median Household Income in Patient's ZIP Code*

Visit Type	≤$32,793 (95% CI) (N)	$32,794-$40,626 (95% CI) (N)	$40,627-$52,387 (95% CI) (N)	≥$52,388 (95% CI) (N)	Design-based Pearson
All Visit Types	21.1% (17.2-25.7) (479,368)	18.7% (14.0-24.6) (332,411)	20.8% (16.4-26.0) (366,545)	23.3% (18.5-28.9) (359,254)	$F_{2.9, 509}$=0.54 p=0.65
Admitted Only	5.9% (3.7-9.2) (138,251)	4.5% (2.6-7.7) (79,361)	4.5% (2.6-7.7) (79,657)	8.3% (5.4-12.5) (127,585)	$F_{2.6, 452}$=1.5 p=0.21
Transferred Only	5.7% (3.8-8.5) (134,543)	3.6% (2.1-6.0) (63,616)	4.0% (2.1-7.6) (70,146)	3.2%* (1.6-6.1) (48,755)	$F_{2.8, 494}$=1.1 p=0.35
Discharged Only	9.6% (7.2-12.7) (2,355,146)	10.7% (7.3-15.5) (1,775,208)	12.3% (9.2-16.4) (1,761,915)	11.9% (8.8-15.8) (1,524,503)	$F_{2.8, 490}$=0.57 p=0.62

*Unreliable: standard error >30% of estimate

Table J39. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Median Household Income in Patient's ZIP Code*

Visit Type	≤$32,793 (95% CI) (N)	$32,794-$40,626 (95% CI) (N)	$40,627-$52,387 (95% CI) (N)	≥$52,388 (95% CI) (N)	Design-based Pearson
All Visit Types	9.2% (7.6-11.1) (3,045,976)	9.3% (7.8-11.2) (2,562,508)	11.1% (9.5-12.9) (2,791,381)	11.7% (10.0-13.5) (2,574,988)	$F_{2.7, 478}$=2.5 p=0.06
Admitted Only	3.2% (2.4-4.1) (1,046,564)	3.7% (2.9-4.8) (1,024,967)	4.4% (3.5-5.5) (1,114,597)	4.3% (3.5-5.4) (959,512)	$F_{2.8, 490}$=2.2 p=0.09
Transferred Only	No reliable estimates available*				
Discharged Only	5.9% (4.9-7.1) (1,951,399)	5.4% (4.5-6.5) (1,479,393)	6.5% (5.6-7.6) (1,643,247)	7.2% (6.1-8.5) (1,592,473)	$F_{2.8, 491}$=2.2 p=0.09

*Unreliable: standard error >30% of estimate

Table J40. *Proportion of ED Visits Resulting in Boarding by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code*

Visit Type	<12.84% (95% CI) (N)	12.84%-19.66% (95% CI) (N)	19.67%-31.68% (95% CI) (N)	≥31.69% (95% CI) (N)	Design-based Pearson
All Visit Types	9.8% (8.3-11.7) (3,371,882)	9.9% (8.4-11.6) (3,076,412)	12.0% (10.4-13.7) (3,234,799)	12.5% (10.8-14.5) (2,846,632)	$F_{2.7, 460}$=3.5 p=0.02

Admitted Only	3.3% (2.5-4.3) (1,133,961)	4.0% (3.1-5.0) (1,227,918)	4.4% (3.7-5.4) (1,196,611)	4.4% (3.5-5.6) (1,011,298)	$F_{2.7, 459}$=1.9 p=0.14
Transferred Only	.52% (.36-.76) (179,035)	.45% (.29-.68) (138,916)	.26% (.15-.46) (70,751)	.43% (.28-.66) (98,516)	$F_{2.9, 501}$=1.6 p=0.19
Discharged Only	6.0% (5.1-7.1) (2,059,789)	5.5% (4.6-6.6) (1,176,218)	7.3% (6.3-8.4) (1,969,362)	7.6% (6.5-8.9) (1,736,818)	$F_{2.9, 490}$=4.4 p=0.0053

Table J41. *Proportion of MHSA Related ED Visits Resulting in Boarding by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code*

Visit Type	<12.84% (95% CI) (N)	12.84%-19.66% (95% CI) (N)	19.67%-31.68% (95% CI) (N)	≥31.69% (95% CI) (N)	Design-based Pearson
All Visit Types	20.1% (16.4-25.9) (433,263)	17.4% (12.8-23.1) (344,302)	20.3% (15.8-25.6) (369,859)	26.5% (21.7-31.9) (407,448)	$F_{2.9, 500}$=2.1 p=0.0999
Admitted Only	4.5% (2.7-7.5) (94,632)	4.8%* (2.4-9.4) (94,370)	6.0% (4.0-9.1) (110,094)	8.1% (5.7-11.5) (125,052)	$F_{2.8, 483}$=1.3 p=0.29
Transferred Only	4.9% (3.3-7.4) (102,349)	4.5% (2.7-7.4) (88,307)	2.9%* (1.5-5.7) (53,105)	4.8% (2.8-8.0) (73,299)	$F_{2.9, 501}$=0.73 p=0.53
Discharged Only	11.4% (8.4-15.3) (237,185)	8.2% (5.2-12.7) (162,179)	11.4% (8.5-14.9) (207,214)	13.6% (10.1-18.0) (209,097)	$F_{2.7, 474}$=1.5 p=0.23

*Unreliable: standard error >30% of estimate

Table J42. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code*

Visit Type	<12.84% (95% CI) (N)	12.84%-19.66% (95% CI) (N)	19.67%-31.68% (95% CI) (N)	≥31.69% (95% CI) (N)	Design-based Pearson
All Visit Types	9.1% (7.6-10.9) (2,938,619)	9.4% (7.9-11.1) (2,732,110)	11.4% (9.8-13.1) (2,864,940)	11.5% (9.8-13.4) (2,439,184)	$F_{2.7, 467}$=3.1 p=0.03
Admitted Only	3.2% (2.4-4.3) (1,039,329)	3.9% (3.1-4.9) (1,133,548)	4.3% (3.5-5.2) (1,086,517)	4.2% (3.3-5.3) (886,246)	$F_{2.6, 459}$=1.7 p=0.18
Transferred Only	No reliable estimates available*				

Discharged Only	5.7% (4.7-6.8) (1,822,604)	5.3% (4.5-6.4) (1,554,039)	7.0% (6.0-8.2) (1,762,148)	7.2% (6.1-8.4) (1,527,721)	$F_{2.9, 499}$=3.8 p=0.0109

*Unreliable: standard error >30% of estimate

Table J43. *Proportion of ED Visits Resulting in Boarding by the Urban-Rural Classification of the Patient's ZIP Code*

Visit Type	Large Central Metro (95% CI) (N)	Large Fringe Metro (95% CI) (N)	Medium Metro (95% CI) (N)	Small Metro (95% CI) (N)	Non-Metro and Micro-politan (95% CI) (N)	Design-based Pearson
All Visit Types	15.1% (13.1-17.3) (4,509,420)	12.2% (10.5-14.2) (3,155,944)	10.2% (8.4-12.4) (3,424,221)	7.8% (5.1-11.6) (563,396)	5.6% (4.3-7.3) (1,197,457)	$F_{3.7, 363}$=12.8 p<0.0001
Admitted Only	5.6% (4.5-6.8) (1,659,889)	4.5% (3.5-5.7) (1,153,440)	3.8% (2.7-5.2) (1,262,070)	2.5% (1.4-4.2) (177,967)	2.0% (1.3-3.1) (420,030)	$F_{3.4, 585}$=5.9 p=0.0003
Transferred Only	.36% (.25-.52) (107,388)	.43% (.25-.74) (110,620)	.45% (.28-.71) (150,023)	.32%* (.13-.75) (23,012)	.45% (.26-.76) (96,175)	$F_{3.6, 616}$=0.22 p=0.91
Discharged Only	9.2% (8.0-10.6) (2,745,525)	7.3% (6.3-8.5) (1,891,884)	6.0% (4.9-7.3) (2,012,128)	5.0% (3.3-7.4) (362,417)	3.2% (2.5-4.1) (687,338)	$F_{3.6, 621}$=14.1 p<0.0001

*Unreliable: standard error >30% of estimate

Table J44. *Proportion of MHSA Related ED Visits Resulting in Boarding by the Urban-Rural Classification of the Patient's ZIP Code*

Visit Type	Large Central Metro (95% CI) (N)	Large Fringe Metro (95% CI) (N)	Medium Metro (95% CI) (N)	Small Metro (95% CI) (N)	Non-Metro and Micro-politan (95% CI) (N)	Design-based Pearson
All Visit Types	27.2% (23.2-31.6) (607,337)	23.6% (18.0-30.3) (372,467)	20.9% (16.4-26.3) (432,275)	10.2%* (5.1-19.6) (47,566)	10.7% (7.4-15.2) (133,641)	$F_{3.7, 653}$=6.7 p<0.0001
Admitted Only	8.0% (5.7-11.1) (178,222)	7.8% (4.7-12.8) (123,563)	5.5% (3.2-9.3) (114,122)	1.9%* (.44-7.6) (8,729)	.54%* (.16-1.8) (6,733)	$F_{3.3, 577}$=4.8 p=0.0019
Transferred Only	2.6% (1.7-4.0) (58,518)	4.4%* (2.1-8.8) (69,163)	5.7% (3.4-9.3) (117,449)	2.7%* (.81-8.5) (12,489)	4.7% (2.9-7.7) (59,441)	$F_{3.4, 593}$=1.3 p=0.26
Discharged Only	16.7% (13.2-20.8) (372,608)	11.4% (8.2-15.7) (179,741)	9.7% (7.2-13.1) (200,704)	5.7%* (2.1-14.7) (26,348)	5.4% (3.0-9.6) (67,467)	$F_{3.8, 672}$=5.5 p=0.0003

*Unreliable: standard error >30% of estimate

Table J45. *Proportion of Non-MHSA Related ED Visits Resulting in Boarding by the Urban-Rural Classification of the Patient's ZIP Code*

Visit Type	Large Central Metro (95% CI) (N)	Large Fringe Metro (95% CI) (N)	Medium Metro (95% CI) (N)	Small Metro (95% CI) (N)	Non-Metro and Micro-politan (95% CI) (N)	Design-based Pearson
All Visit Types	14.1% (12.1-16.3) (3,902,083)	11.5% (9.8-13.5) (2,783,477)	9.5% (7.7-11.6) (2,991,946)	7.6% (5.0-11.4) (515,830)	5.3% (4.0-6.9) (1,063,816)	$F_{3.7, 649}$=11.5 p<0.0001
Admitted Only	5.4% (4.3-6.7) (1,481,667)	4.3% (3.3-5.5) (1,029,887)	3.6% (2.6-5.0) (1,147,948)	2.5% (1.5-4.1) (169,238)	2.1% (1.3-3.2) (413,297)	$F_{3.4, 587}$=5.2 p=0.0010
Transferred Only	No reliable estimates available*					
Discharged Only	8.6% (7.4-10.0) (2,372,917)	7.1% (6.0-8.3) (1,712,143)	5.8% (4.7-7.0) (1,811,424)	5.0% (3.2-7.5) (336,069)	3.1% (2.4-4.0) (619,871)	$F_{3.7, 639}$=12.1 p<0.0001

*Unreliable: standard error >30% of estimate

Table J46. *Mean Patient Boarding Time in Minutes by Type and Region (N=13,656,488)*

Visit Type	Northeast (95% CI)	Midwest (95% CI)	South (95% CI)	West (95% CI)	Pearson
All Visit Types	259.1 (186.9-331.2)	231.7 (196.0-267.4)	186.8 (163.9-209.7)	193.3 (147.8-238.8)	$F_{3, 172}$=2.30 p=0.08
Admitted Only	344.3 (175.7- 512.9)	256.4 (191.8- 321.0)	189.4 (165.4- 213.4)	200.3 (130.8-269.8)	$F_{3, 147}$=2.17 p=0.09
Transferred Only	267.2 (178.0-356.4)	181.3 (105.7-256.9)	244.3 (137.1-351.5)	215.1* (78.9-351.2)	$F_{3, 67}$=0.75 p=0.53
Discharged Only	199.4 (166.7-232.1)	214.6 (162.0-267.2)	180.2 (152.1-208.3)	188.4 (135.4-241.3)	$F_{3, 171}$=0.53 p=0.67

*Unreliable: standard error >30% of estimate

Table J47. *MHSA Mean Patient Boarding Time in Minutes by Type and Region (N=1,745,528)*

Visit Type	Northeast (95% CI)	Midwest (95% CI)	South (95% CI)	West (95% CI)	Pearson
All Visit Types	381.3 (316.0-446.6)	270.7 (188.4-352.9)	228.8 (180.4-277.2)	294.6 (190.6-398.7)	$F_{3, 127}$=4.52 p=0.0048
Admitted Only	364.7 (269.8-459.6)	226.8 (118.5-335.2)	192.2 (124.3-260.1)	437.3* (173.2-701.4)	$F_{3, 66}$=3.34 p=0.02
Transferred Only	266.3 (184.9-347.7)	203.8 (115.0-292.7)	271.9 (146.4-397.4)	207.9* (59.7-356.1)	N/A**
Discharged Only	422.9 (336.3-509.6)	319.2 (165.0-473.3)	217.3 (169.9-264.7)	273.4 (187.1-359.6)	$F_{3, 101}$=5.61 p=0.0014

*Unreliable: standard error >30% of estimate

**Unable to calculate due to one stratum with single sampling unit

Table J48. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Region (N=11,910,960)*

Visit Type	Northeast (95% CI)	Midwest (95% CI)	South (95% CI)	West (95% CI)	Pearson
All Visit Types	240.4 (154.3-326.5)	226.3 (188.7-264.0)	181.1 (156.1-206.1)	176.3 (131.4-221.3)	$F_{3, 171}$=1.86 p=0.14
Admitted Only	342.1 (155.6-528.6)	259.7 (189.7-329.8)	189.1 (163.1-215.2)	178.5 (125.0-232.1)	$F_{3, 144}$=2.07 p=0.11
Transferred Only	No reliable estimates available*				
Discharged Only	166.3 138.7-194.0	201.6 (149.2-254.1)	176.6 (146.7-206.5)	173.9 (110.5-237.2)	$F_{3, 169}$=0.46 p=0.71

*Unreliable: standard error >30% of estimate

Table J49. *Mean Patient Boarding Time in Minutes by Type and Ownership (N=13,656,488*)

Visit Type	Voluntary Non-Profit (95% CI)	Government Non-Federal (95% CI)	Proprietary (95% CI)	Pearson
All Visit Types	211.6 (181.3-241.9)	254.5 (215.6-293.3)	185.1 (140.6-229.6)	$F_{2, 173}$=2.82 p=0.06
Admitted Only	252.5 (182.5-322.6)	271.2 (212.8-329.6)	218.1 (149.1-287.2)	$F_{2, 148}$=0.69 p=0.50
Transferred Only	192.4 (134.1-250.7)	604.4* (239.6-969.1)	211.1* (5.6-416.5)	$F_{2, 68}$=2.30 p=0.11
Discharged Only	185.7 (163.1-208.3)	235.4 (194.2-276.5)	171.7 (125.4-217.9)	$F_{2, 172}$=2.60 p=0.08

*Unreliable: standard error >30% of estimate

Table J50. *MHSA Mean Patient Boarding Time in Minutes by Type and Ownership (N=1,745,528*)

Visit Type	Voluntary Non-Profit (95% CI)	Government Non-Federal (95% CI)	Proprietary (95% CI)	Pearson
All Visit Types	265.1 (222.8-307.5)	389.4 (303.4-475.5)	277.3 (180.3-374.4)	$F_{2, 128}$=3.25 p=0.04
Admitted Only	263.8 (188.1-339.5)	380.4 (253.6-507.2)	167.6 (71.1-264.1)	$F_{2, 67}$=3.17 p=0.0485
Transferred Only	193.5 (145.4-241.7)	751.8* (244.7-1258.9)	153.9 (116.1-191.7)	N/A**
Discharged Only	299.4 (233.3-365.6)	334.2 (247.8-420.7)	311.7 (209.4-414.1)	$F_{2, 102}$=0.20 p=0.82

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J51. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Ownership (N=11,910,960)*

Visit Type	Voluntary Non-Profit (95% CI)	Government Non-Federal (95% CI)	Proprietary (95% CI)	Pearson
All Visit Types	204.5 (170.5-238.5)	223.8 (186.2-261.4)	171.5 (126.6-216.5)	$F_{2, 172}$=1.54 p=0.22
Admitted Only	251.6 (176.4-326.7)	240.1 (189.5-290.7)	220.6 (148.4-292.8)	$F_{2, 145}$=0.18 p=0.83
Transferred Only	No reliable estimates available*			
Discharged Only	172.7 (149.6-195.7)	217.7 (172.5-262.9)	148.7 (106.8-190.6)	$F_{2, 170}$=2.34 p=0.10

*Unreliable: standard error >30% of estimate

Table J52. *Mean Patient Boarding Time in Minutes by Type and MSA Status (N=13,656,488)*

Visit Type	MSA (95% CI)	Non-MSA (95% CI)	Pearson
All Visit Types	215.5 (189.8-241.2)	225.4 (132.2-318.7)	$F_{1, 174}$=0.04 p=0.84
Admitted Only	251.1 (188.3-313.9)	279.8 (151.1-408.4)	$F_{1, 149}$=0.15 p=0.70
Transferred Only	267.1 (194.9-339.3)	101.9 (42.1-161.7)	$F_{1, 69}$=11.81 p=0.001
Discharged Only	192.0 (172.7-211.2)	211.9 (99.7-324.1)	$F_{1, 173}$=0.12 p=0.73

Table J53. *MHSA Mean Patient Boarding Time in Minutes by Type and MSA Status (N=1,745,528)*

Visit Type	MSA (95% CI)	Non-MSA (95% CI)	Pearson
All Visit Types	299.8 (260.8-338.8)	172.7* (30.4-315.0)	$F_{1, 129}$=2.73 p=0.10
Admitted Only	293.9 (227.8-360.0)	No data available	
Transferred Only	284.1 (206.0-362.1)	104.7* (22.0-187.4)	N/A**
Discharged Only	308.4 (257.3-359.6)	311.1* (8.2-614.0)	$F_{1, 103}$<0.005 p=0.99

*Unreliable: standard error >30% of estimate

**Unable to calculate due to one stratum with single sampling unit

Table J54. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and MSA Status (N=11,910,960)*

Visit Type	MSA (95% CI)	Non-MSA (95% CI)	Pearson
All Visit Types	203.0 (173.9-232.1)	231.7 (138.8-324.5)	$F_{1, 173}=0.33$ p=0.56
Admitted Only	246.4 (177.4-315-3)	279.8 (151.1-408.4)	$F_{1, 146}=0.20$ p=0.70
Transferred Only	No reliable estimates available*		
Discharged Only	176.5 (156.8-196.3)	204.7 (90.0-319.5)	$F_{1, 171}=0.23$ p=0.63

*Unreliable: standard error >30% of estimate

Table J55. *Mean Patient Boarding Time in Minutes by Type and Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007 (N=10,827,791)*

Visit Type	0 Hours (95% CI)	1-99 Hours (95% CI)	100-499 Hours (95% CI)	≥500 Hours (95% CI)	Pearson
All Visit Types	201.0 (172.7-229.4)	208.5 (158.3-258.7)	206.9 (165.5-248.3)	244.6 (155.7-333.5)	$F_{3, 133}=0.28$ p=0.84
Admitted Only	247.3 (174.2-320.4)	209.7 (123.6-295.8)	240.9 (170.4-311.4)	296.5* (95.3-497.8)	$F_{3, 133}=0.29$ p=0.84
Transferred Only	216.5 (72.8-360.2)	218.1 (108.1-328.0)	183.3 (76.6-290.0)	257.6 (152.0-363.2)	$F_{3, 47}=0.32$ p=0.81
Discharged Only	176.1 (136.8-215.3)	207.1 (156.9-257.3)	188.6 (153.9-223.2)	203.4 (153.7-253.0)	$F_{3, 133}=0.49$ p=0.69

*Unreliable: standard error >30% of estimate

Table J56. *MHSA Mean Patient Boarding Time in Minutes by Type and Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007 (N=1,399,963)*

Visit Type	0 Hours (95% CI)	1-99 Hours (95% CI)	100-499 Hours (95% CI)	≥500 Hours (95% CI)	Pearson
All Visit Types	251.1 (173.1-329.2)	347.6 (235.0-460.1)	300.0 (241.2-358.7)	286.9 (193.1-380.8)	$F_{3, 101}=0.65$ p=0.58
Admitted Only	240.9 (134.7-347.1)	311.6* (78.1-545.1)	359.4 (210.1-508.6)	278.9 (167.0-390.7)	$F_{3, 50}=0.57$ p=0.64
Transferred Only	289.9* (73.0-506.8)	140.3 (87.5-193.1)	188.4* (68.2-308.6)	342.4 (214.0-470.9)	N/A**
Discharged Only	228.9 (133.4-324.3)	430.5 (276.7-584.2)	309.1 (237.3-381.0)	278.3 (165.7-390.9)	$F_{3, 74}=1.61$ p=0.19

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J57. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Aggregate Number of Hours the Hospital Was on Ambulance Diversion in 2007 (N=9,427,828)*

Visit Type	0 Hours (95% CI)	1-99 Hours (95% CI)	100-499 Hours (95% CI)	≥500 Hours (95% CI)	Pearson
All Visit Types	196.0 (164.9-227.1)	182.5 (136.7-228.3)	189.1 (148.5-229.7)	238.4 (134.9-341.9)	$F_{3,\ 132}$=0.34 p=0.80
Admitted Only	247.7 (169.7-325.6)	195.0 (125.9-264.0)	228.4 (156.1-300.7)	298.7* (75.2-522.1)	$F_{3,\ 110}$=0.54 p=0.65
Transferred Only	No reliable estimates available*				
Discharged Only	172.2 (131.0-213.3)	170.0 (122.7-217.3)	164.9 (133.3-196.5)	193.2 (135.6-250.8)	$F_{3,\ 131}$=0.24 p=0.87

*Unreliable: standard error >30% of estimate

Table J58. *Mean Patient Boarding Time in Minutes by Type and Safety Net Status (N=13,656,488)*

Visit Type	Safety Net (95% CI)	Non-Safety Net (95% CI)	Pearson
All Visit Types	229.1 (182.3-275.9)	202.7 (178.2-227.3)	$F_{1,\ 172}$=0.93 p=0.34
Admitted Only	317.0 (178.3-455.7)	209.4 (173.2-245.7)	$F_{1,\ 148}$=2.11 p=0.15
Transferred Only	235.7 (143.0-328.3)	231.5 (140.7-322.3)	$F_{1,\ 69}$<0.005 p=0.95
Discharged Only	189.7 (162.5-216.8)	195.4 (168.7-222.1)	$F_{1\ 171}$=0.09 p=0.76

Table J59. *MHSA Mean Patient Boarding Time in Minutes by Type and Safety Net Status (N=1,745,528)*

Visit Type	Safety Net (95% CI)	Non-Safety Net (95% CI)	Pearson
All Visit Types	308.0 (249.8-366.1)	274.1 (231.4-316.7)	$F_{1,\ 129}$=0.88 p=0.35
Admitted Only	302.5 (208.6-396.4)	286.3 (191.6-381.0)	$F_{1,\ 68}$=0.05 p=0.82
Transferred Only	281.3 (163.6-398.9)	208.3 (149.1-267.6)	N/A**
Discharged Only	321.5 (248.8-394.3)	290.9 (232.4-349.4)	$F_{1\ 103}$=0.45 p=0.51

**Unable to calculate due to one stratum with single sampling unit

Table J60. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Safety Net Status (N=11,910,960)*

Visit Type	Safety Net (95% CI)	Non-Safety Net (95% CI)	Pearson
All Visit Types	215.1 (160.8-269.4)	193.9 (168.0-219.8)	$F_{1, 171}$=0.47 p=0.49
Admitted Only	318.9 (163.7-474.1)	202.7 (166.5-239.0)	$F_{1, 145}$=2.00 p=0.16
Transferred Only	102.2 (30.3-174.0)	262.6* (72.2-453.1)	$F_{1, 30}$=2.37 p=0.13
Discharged Only	170.3 (144.6-195.9)	184.5 (154.4-214.6)	$F_{1\ 169}$=0.52 p=0.47

*Unreliable: standard error >30% of estimate

Table J61. *Mean Patient Boarding Time in Minutes by Type and Residence (N=13,656,488)*

Visit Type	Private Residence (95% CI)	Nursing Home (95% CI)	Other Institution (95% CI)	Other Residence (95% CI)	Homeless (95% CI)	Pearson
All Visit Types	210.6 (185.2-236.0)	214.5 (158.9-270.1)	283.3 (174.4-392.1)	268.5 (137.9-399.0)	418.8 (327.1-510.5)	$F_{4, 170}$=5.03 p=0.0007
Admitted Only	257.6 (193.1-322.0)	184.8 (124.8-244.8)	228.3 (133.5-323.1)	325.7* (60.4-591.0)	555.5 (277.1-833.8)	$F_{4, 144}$=3.07 p=0.02
Transferred Only	199.7 (141.8-257.7)	363.7* (85.0-642.5)	785.6 (764.2-807.1)	353.5* (-77.6-784.5)	592.9 (334.9-850.9)	$F_{4, 64}$=91.95 p<0.0001
Discharged Only	185.5 (165.0-205.9)	263.9 (155.7-372.2)	283.8 (126.4-441.3)	227.6 (130.3-324.8)	373.0 (281.1-465.0)	$F_{4, 169}$=4.22 p=0.0028

*Unreliable: standard error >30% of estimate

Table J62. *MHSA Mean Patient Boarding Time in Minutes by Type and Residence (N=1,745,528)*

Visit Type	Private Residence (95% CI)	Nursing Home (95% CI)	Other Institution (95% CI)	Other Residence (95% CI)	Homeless (95% CI)	Pearson
All Visit Types	260.2 (224.6-295.7)	222.0 (130.4-313.7)	394.1 (188.5-599.7)	718.6 (316.2-1120.9)	552.6 (433.6-671.6)	$F_{4, 122}$=6.41 p=0.0001
Admitted Only	275.7 (205.5-346.0)	137.8 (98.1-177.4)	185.8* (38.6-333.1)	1118.7 (486.3-1751.1)	628.8 (310.5-947.1)	$F_{4, 63}$=6.27 p=0.0003

Transferred Only	199.1 (148.8-249.3)	448.2* (111.5-784.9)	785.6 (764.2-807.1)	513.5* (-68.8-1095.8)	592.9 (334.9-850.9)	N/A**
Discharged Only	280.6 (228.2-332.9)	493.7* (69.0-918.5)	466.1* (92.0-840.2)	513.9 (324.1-703.6)	516.7 (390.3-643.1)	$F_{4, 96}$=4.61 p=0.0019

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J63. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Residence (N=11,910,960)*

Visit Type	Private Residence (95% CI)	Nursing Home (95% CI)	Other Institution (95% CI)	Other Residence (95% CI)	Homeless (95% CI)	Pearson
All Visit Types	204.0 (175.6-232.4)	213.4 (153.2-273.7)	244.1 (128.8-359.4)	180.7 (120.5-240.9)	210.0 (136.0-284.0)	$F_{4, 169}$=0.26 p=0.90
Admitted Only	256.0 (187.0-325.0)	192.1 (123.6-260.5)	246.6 (139.3-353.8)	189.7 (93.9-285.5)	276.0 (122.1-429.8)	$F_{4\ 141}$=1.38 p=0.24
Transferred Only	201.0 (70.7-331.2)	216.2* (-146.7-579.1)	No Data	19.0 (19.0-19.0)	No Data	$F_{2\ 29}$=4.28 p=0.02
Discharged Only	174.5 (153.4-195.5)	252.0 (141.6-362.3)	242.7* (74.7-410.7)	178.2 (85.9-270.5)	200.6 (117.0-284.2)	$F_{4, 167}$=0.67 p=0.61

*Unreliable: standard error >30% of estimate

Table J64. *Mean Patient Boarding Time in Minutes by Type and Race/Ethnicity (N=13,656,488*)

Visit Type	Non-Hispanic White (95% CI)	Non-Hispanic Black (95% CI)	Hispanic (95% CI)	Asian (95% CI)	Native Hawaiian/ Pacific Islander (95% CI)	American Indian/ Alaska Native (95% CI)	Multiple Races (95% CI)	Pearson
All Visit Types	201.8 (181.3-222.2)	246.1 (176.9-315.3)	209.0 (163.9-254.4)	280.3 (185.3-375.2)	246.4 (112.1-380.6)	202.4 (137.5-267.3)	262.3 (215.8-308.8)	$F_{6, 169}$=1.72 p=0.12
Admitted Only	220.3 (188.8-251.9)	341.1 (148.0-534.1)	285.8 (161.7-409.9)	221.9 (111.3-332.5)	159.5* (60.9-258.1)	141.6* (33.7-249.5)	126.0* (-6.6-258.6)	$F_{6, 144}$=1.04 p=0.40
Transferred Only	234.5 (158.2-310.9)	188.9 (129.3-248.4)	323.0* (-67.1-713.2)	403.8* (25.9-781.6)	No Data	No Data	121.0 (121.0-121.0)	$F_{4, 66}$=3.64 p=0.0097
Discharged Only	186.3 (160.1-212.5)	200.4 (166.7-234.0)	172.5 (146.8-198.3)	317.7 (189.5-445.9)	306.1* (83.9-528.3)	232.1 (167.6-296.5)	279.4 (226.1-332.8)	$F_{6, 168}$=3.70 p=0.0018

*Unreliable: standard error >30% of estimate

Table J65. *MHSA Mean Patient Boarding Time in Minutes by Type and Race/Ethnicity (N=1,745,528)*

Visit Type	Non-Hispanic White (95% CI)	Non-Hispanic Black (95% CI)	Hispanic (95% CI)	Asian (95% CI)	Native Hawaiian/ Pacific Islander (95% CI)	American Indian/ Alaska Native (95% CI)	Multiple Races (95% CI)	Pearson
All Visit Types	271.1 (229.5-312.8)	300.4 (211.6-389.1)	291.9 (185.4-398.3)	479.0 (316.2-641.7)	1255.4* (191.1-2319.8)	540.0 (540.0-540.0)	357.0 (219.6-494.4)	$F_{6, 124}$=39.9 p<0.0001
Admitted Only	301.2 (213.0-389.3)	190.7 (116.8-264.7)	363.3* (129.4-597.2)	425.5 (216.6-634.3)	44.3 (44.3-44.3)	394.0 (394.0-394.0)	191.0* (-25.3-407.3)	N/A**
Transferred Only	224.6 (164.1-285.0)	235.2 (154.1-316.3)	419.0* (-125.0-963.0)	436.3* (18.7-853.9)	No Data	No Data	121.0 (121.0-121.0)	N/A**
Discharged Only	277.0 (223.8-330.3)	388.5 (230.3-546.8)	225.8 (154.1-297.5)	577.4 (372.4-782.5)	1812.0 (1812.0-1812.0)	593.9 (593.9-593.9)	412.2 (269.7-554.8)	N/A**

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J66. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Race/Ethnicity (N=11,910,960)*

Visit Type	Non-Hispanic White (95% CI)	Non-Hispanic Black (95% CI)	Hispanic (95% CI)	Asian (95% CI)	Native Hawaiian/ Pacific Islander (95% CI)	American Indian/ Alaska Native (95% CI)	Multiple Races (95% CI)	Pearson
All Visit Types	191.8 (169.4-214.2)	239.3 (160.6-317.9)	194.6 (150.8-238.4)	231.8 (133.3-330.3)	189.0 (129.6-248.3)	173.2 (120.2-226.2)	229.6 (189.1-270.0)	$F_{6, 168}$=0.95 p=0.46
Admitted Only	213.5 (181.5-245.6)	356.5 (148.1-564.9)	272.0 (156.0-388.0)	153.9 (89.5-218.3)	164.5* (63.6-265.4)	124.0* (13.7-234.3)	97.0* (-33.2-227.2)	$F_{6, 141}$=1.48 p=0.19
Transferred Only	No reliable estimates available*							
Discharged Only	173.9 (145.8-202.1)	182.0 (150.4-213.6)	165.0 (137.6-192.4)	279.0 (143.6-414.5)	206.2 (104.9-307.5)	197.8 (153.9-241.8)	240.3 (196.9-283.7)	$F_{6, 166}$=1.96 p=0.07

*Unreliable: standard error >30% of estimate

Table J67. *Mean Patient Boarding Time in Minutes by Type and Expected Source of Payment (N=13,656,488)*

Visit Type	Private Insurance (95% CI)	Medicare (95% CI)	Medicaid (95% CI)	Worker's Comp (95% CI)	Self-Pay (95% CI)	No Charge (95% CI)	Other (95% CI)	Pearson
All Visit Types	197.5 (169.0-225.9)	224.8 (181.5-268.0)	232.1 (189.3-274.8)	332.6 (136.7-528.5)	209.1 (175.7-242.6)	209.0 (139.8-278.2)	198.5 (152.5-244.4)	$F_{6, 167}$=0.71 p=0.64

Admitted Only	239.2 (175.8-302.5)	254.0 (182.3-325.7)	263.2 (160.6-365.9)	246.1* (-40.5-532.7)	256.2 (179.5-332.6)	525.3* (202.2-848.3)	192.7 (99.2-286.2)	$F_{6, 142}$=0.97 p=0.45
Transferred Only	141.9 (83.5-200.3)	234.9 (96.2-373.6)	275.7 (161.7-389.8)	No Data	440.3* (141.2-739.5)	179.0 (179.0-179.0)	329.8 (139.1-520.5)	$F_{5, 63}$=1.68 p=0.15
Discharged Only	182.3 (152.8-211.8)	181.7 (153.4-210.0)	216.7 (170.5-262.8)	362.1* (130.0-594.2)	187.8 (152.4-223.2)	152.1 (110.2-194.0)	196.9 (137.1-256.8)	$F_{6, 165}$=1.01 p=0.42

*Unreliable: standard error >30% of estimate

Table J68. *MHSA Mean Patient Boarding Time in Minutes by Type and Expected Source of Payment (N=1,745,528)*

Visit Type	Private Insurance (95% CI)	Medicare (95% CI)	Medicaid (95% CI)	Worker's Comp (95% CI)	Self-Pay (95% CI)	No Charge (95% CI)	Other (95% CI)	Pearson
All Visit Types	284.8 (219.3-350.2)	236.2 (160.7-311.7)	321.1 (251.3-390.8)	No Data	341.3 (261.3-421.4)	129.7 (65.8-193.7)	348.3* (100.1-596.5)	$F_{5, 123}$=4.99 p=0.0003
Admitted Only	399.9 (170.7-629.1)	244.0 (133.2-354.7)	317.2 (216.2-418.1)	No Data	289.2 (142.2-436.3)	189.0 (189.0-189.0)	48.1 (27.8-68.4)	$F_{5, 63}$=37.0 p<.0001
Transferred Only	175.7 (96.0-255.4)	162.1* (56.3-268.0)	279.1 (161.5-396.6)	No Data	464.1* (130.6-797.6)	179.0 (179.0-179.0)	356.3 (143.5-569.2)	N/A**
Discharged Only	289.9 (210.7-369.0)	276.3 (169.5-383.0)	350.6 (223.0-478.3)	No Data	315.2 (223.6-406.8)	121.6 (49.7-193.5)	515.2* (87.4-943.1)	$F_{5, 97}$=3.23 p=0.0097

*Unreliable: standard error >30% of estimate

**Unable to calculate due to one stratum with single sampling unit

Table J69. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Expected Source of Payment (N=11,910,960)*

Visit Type	Private Insurance (95% CI)	Medicare (95% CI)	Medicaid (95% CI)	Worker's Comp (95% CI)	Self-Pay (95% CI)	No Charge (95% CI)	Other (95% CI)	Pearson
All Visit Types	186.1 (156.8-215.4)	223.7 (177.0-270.3)	215.5 (166.9-264.1)	332.6 (136.7-528.5)	175.4 (136.7-214.1)	235.4 (141.1-329.7)	183.0 (143.5-222.6)	$F_{6, 166}$=0.96 p=0.45
Admitted Only	228.3 (167.3-289.3)	254.8 (178.9-330.7)	250.9 (127.6-374.2)	246.1* (-40.5-532.7)	248.8 (158.9-338.7)	541.3* (205.5-877.0)	204.8 (102.4-307.3)	$F_{6, 139}$=1.10 p=0.37
Transferred Only	No reliable estimates available*							
Discharged Only	168.9 (139.2-198.7)	174.3 (145.1-203.7)	201.5 (154.5-248.5)	362.1* (130.0-594.2)	162.2 (124.1-200.3)	162.9 (115.2-210.7)	170.9 (114.3-227.6)	$F_{6, 163}$=0.62 p=0.72

*Unreliable: standard error >30% of estimate

Table J70. *Mean Patient Boarding Time in Minutes by Type and Age (N=13,656,488)*

Visit Type	<15 yr (95% CI)	15-24 yr (95% CI)	25-44 yr (95% CI)	45-64 yr (95% CI)	65-74 yr (95% CI)	75+ yr (95% CI)	Pearson
All Visit Types	226.1 (178.7-273.5)	218.1 (179.3-256.8)	186.6 (161.5-211.7)	237.5 (200.5-274.6)	217.9 (177.3-258.5)	222.2 (172.6-271.9)	$F_{5, 170}$=1.91 p=0.0953
Admitted Only	243.7 (106.7-380.6)	279.8 (151.4-408.3)	213.9 (164.0-263.9)	296.6 (205.8-387.5)	221.3 (162.6-280.0)	243.0 (170.6-315.5)	$F_{5, 145}$=1.32 p=0.26
Transferred Only	119.0 (43.5-194.5)	161.2 (84.6-237.9)	233.7 (138.4-328.9)	278.8 (131.8-425.7)	219.0* (39.1-398.9)	325.2* (-4.9-655.2)	$F_{5,65}$=1.07 p=0.39
Discharged Only	226.0 (180.7-271.4)	213.9 (169.2-258.6)	175.5 (146.8-204.3)	194.2 (169.4-219.0)	213.4 (153.5-273.3)	179.7 (142.7-216.7)	$F_{5, 169}$=1.58 p=0.17

*Unreliable: standard error >30% of estimate

Table J71. *MHSA Mean Patient Boarding Time in Minutes by Type and Age (N=1,745,528)*

Visit Type	<15 yr (95% CI)	15-24 yr (95% CI)	25-44 yr (95% CI)	45-64 yr (95% CI)	65-74 yr (95% CI)	75+ yr (95% CI)	Pearson
All Visit Types	314.1 (166.4-461.8)	262.1 (180.3-343.9)	266.2 (223.2-309.2)	339.6 (268.7-410.4)	316.7 (133.9-499.4)	269.0 (114.9-423.1)	$F_{5, 125}$=0.73 p=0.61
Admitted Only	67.0 (67.0-67.0)	319.4 (158.0-480.8)	300.2 (210.1-390.2)	307.1 (222.4-391.8)	349.3* (40.6-658.0)	226.5* (6.8-446.3)	$F_{5, 64}$=13.41 p<0.0001
Transferred Only	105.6* (34.0-177.3)	173.0 (86.3-259.8)	246.9 (145.8-348.0)	344.4 (144.0-544.7)	207.3 (85.5-329.2)	352.5 (147.1-558.0)	N/A**
Discharged Only	419.9 (234.7-605.1)	306.6 (167.0-446.2)	257.9 (201.7-314.1)	351.2 (260.4-442.0)	290.3 (178.0-402.7)	344.4 (187.3-501.5)	$F_{5, 99}$=1.20 p=0.32

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J72. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Age (N=11,910,960)*

Visit Type	<15 yr (95% CI)	15-24 yr (95% CI)	25-44 yr (95% CI)	45-64 yr (95% CI)	65-74 yr (95% CI)	75+ yr (95% CI)	Pearson
All Visit Types	220.2 (170.5-270.0)	207.3 (161.9-252.6)	170.7 (142.5-198.9)	221.0 (177.8-264.2)	211.8 (171.1-252.4)	219.5 (167.6-271.5)	$F_{5, 169}$=2.26 p=0.0507

Admitted Only	247.2 (110.0-384.5)	269.1 (106.6-431.5)	195.6 (138.4-252.9)	295.7 (197.1-394.3)	212.6 (156.6-268.7)	244.0 (168.2-319.9)	$F_{5, 142}$=2.11 p=0.07
Transferred Only	No reliable estimates available*						
Discharged Only	214.8 (168.4-261.1)	200.2 (149.9-250.5)	163.0 (131.5-194.5)	168.4 (145.9-190.9)	210.1 (147.6-272.6)	171.6 (132.8-210.4)	$F_{5, 167}$=1.78 p=0.12

*Unreliable: standard error >30% of estimate

Table J73. *Mean Patient Boarding Time in Minutes by Type and Gender (N=13,656,488)*

Visit Type	Female (95% CI)	Male (95% CI)	Pearson
All Visit Types	209.1 (181.6-236.6)	226.4 (198.0-254.9)	$F_{1, 174}$=1.66 p=0.20
Admitted Only	250.0 (184.3-315.8)	257.0 (194.4-319.7)	$F_{1, 149}$=0.07 p=0.79
Transferred Only	245.9 (156.0-335.8)	221.9 (133.8-310.0)	$F_{1, 69}$=0.14 p=0.70
Discharged Only	185.0 (160.9-209.1)	206.0 (183.3-228.7)	$F_{1, 17.3}$=2.19 p=0.14

Table J74. *MHSA Mean Patient Boarding Time in Minutes by Type and Gender (N=1,745,528)*

Visit Type	Female (95% CI)	Male (95% CI)	Pearson
All Visit Types	273.8 (224.0-323.6)	311.1 (258.2-364.0)	$F_{1, 129}$=1.08 p=0.30
Admitted Only	272.5 (202.5-342.4)	326.6 (200.1-453.0)	$F_{1, 68}$=0.51 p=0.48
Transferred Only	255.8 (148.3-363.3)	244.3 (163.0-325.6)	N/A**
Discharged Only	283.9 (201.9-366.0)	326.1 (264.0-388.1)	$F_{1, 103}$=0.64 p=0.43

**Unable to calculate due to one stratum with single sampling unit

Table J75. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Gender (N=11,910,960)*

Visit Type	Female (95% CI)	Male (95% CI)	Pearson
All Visit Types	201.3 (170.7-232.0)	210.6 (178.3-242.9)	$F_{1, 173}$=0.39 p=0.53
Admitted Only	247.5 (174.7-320.4)	250.7 (183.9-317.4)	$F_{1, 146}$=0.01 p=0.91

Transferred Only	No reliable estimates available*		
Discharged Only	176.7 (152.1-201.3)	181.0 (158.6-203.4)	$F_{1, 171}$=0.10 p=0.76

No reliable estimates available*

Table J76. *Mean Patient Boarding Time in Minutes by Type and Frequency of ED Use (N=8,810,211)*

Visit Type	0 Visits (95% CI)	1 Visit (95% CI)	2 Visits (95% CI)	3 Visits (95% CI)	4 Visits (95% CI)	5-9 Visits (95% CI)	>10 Visits (95% CI)	Pearson
All Visit Types	197.4 (167.4-227.4)	193.2 (163.3-223.0)	236.4 (140.2-332.7)	257.4 (114.2-400.5)	223.1 (97.0-349.2)	222.9 (168.3-277.5)	194.9 (129.1-260.7)	$F_{6, 129}$=0.43 p=0.85
Admitted Only	211.6 (159.5-236.8)	223.6 (164.9-282.3)	297.0* (90.9-503.1)	405.1* (72.2-738.0)	338.1* (26.5-649.7)	262.1 (152.4-371.8)	241.9 (179.2-304.6)	$F_{6, 106}$=0.48 p=0.82
Transferred Only	336.2 (174.9-497.4)	207.9 (108.4-307.4)	214.0* (40.2-387.8)	147.4 (77.8-217.0)	245.4* (-162.9-653.6)	275.2 (114.9-435.5)	211.3* (-32.3-454.9)	$F_{6, 34}$=0.78 p=0.59
Discharged Only	178.0 (143.0-212.9)	172.2 (136.4-208.0)	189.0 (151.8-226.2)	170.5 (119.2-221.7)	159.5 (106.3-212.8)	191.9 (136.0-247.8)	176.2 (85.9-266.4)	$F_{6, 123}$=0.30 p=0.94

*Unreliable: standard error >30% of estimate

Table J77. *MHSA Mean Patient Boarding Time in Minutes by Type and Frequency of ED Use (N=1,177,153)*

Visit Type	0 Visits (95% CI)	1 Visit (95% CI)	2 Visits (95% CI)	3 Visits (95% CI)	4 Visits (95% CI)	5-9 Visits (95% CI)	>10 Visits (95% CI)	Pearson
All Visit Types	294.3 (222.4-366.3)	253.5 (167.3-339.8)	335.1 (249.7-420.6)	272.5 (115.1-429.9)	366.6 (159.3-573.8)	252.9* (100.1-405.7)	174.6 (71.8-277.5)	$F_{6, 87}$=1.09 p=0.37
Admitted Only	275.8 (143.9-407.6)	284.1 (190.1-378.0)	275.7 (162.0-389.5)	392.8* (9.4-776.2)	610.8 (321.1-900.5)	104.2* (-3.9-212.3)	167.0* (12.7-321.3)	N/A**
Transferred Only	359.7 (161.6-557.8)	234.9 (120.9-348.9)	287.7* (7.0-568.4)	151.8* (43.0-260.6)	95.4* (-62.7-253.5)	212.2* (66.0-358.5)	212.6* (-53.8-478.9)	N/A**
Discharged Only	281.0 (192.0-370.0)	241.0 (98.5-383.6)	374.3 (266.4-482.2)	363.9* (132.4-595.4)	399.6 (182.8-616.3)	329.8* (112.8-546.9)	164.8* (53.3-276.2)	$F_{6, 70}$=1.86 p=0.0997

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J78. *Non-MHSA Mean Patient Boarding Time in Minutes by Type and Frequency of ED Use (N=7,633,058)*

Visit Type	0 Visits (95% CI)	1 Visit (95% CI)	2 Visits (95% CI)	3 Visits (95% CI)	4 Visits (95% CI)	5-9 Visits (95% CI)	>10 Visits (95% CI)	Pearson
All Visit Types	181.8 (150.3-213.3)	184.5 (152.5-216.5)	225.4 (117.3-333.4)	255.6* (95.7-415.5)	198.8* (52.6-345.0)	217.6 (154.6-280.7)	202.3 (120.6-284.0)	$F_{6, 124}$=1.07 p=0.39
Admitted Only	203.9 (154.0-253.8)	216.1 (150.0-282.1)	298.7* (77.0-520.3)	406.4* (41.4-771.3)	316.3* (-22.2-654.8)	281.2 (162.4-400.0)	252.2 (185.6-318.8)	$F_{6, 100}$=0.81 p=0.56
Transferred Only	No reliable estimates available*							
Discharged Only	163.4 (126.3-200.5)	164.2 (127.3-201.0)	165.6 (130.0-201.1)	161.7 (109.2-214.2)	120.8 (75.8-165.9)	165.1 (113.8-216.4)	180.3* (65.0-295.7)	$F_{6, 117}$=0.58 p=0.75

*Unreliable: standard error >30% of estimate

Table J79. *Mean Patient Boarding Time in Minutes by Level of Poverty in Patient's ZIP Code (N=12,529,729)*

Visit Type	<5.0% (95% CI)	5.0-9.9% (95% CI)	10.0-19.9% (95% CI)	≥20% (95% CI)	Pearson
All Visit Types	199.5 (164.7-234.3)	205.9 (177.0-234.8)	200.8 (172.1-229.4)	252.8 (193.0-312.6)	$F_{3, 169}$=1.41 p=0.24
Admitted Only	228.8 (150.6-307.0)	231.1 (179.0-283.2)	219.1 (160.4-277.7)	363.7 (201.5-525.8)	$F_{3, 141}$=2.37 p=0.07
Transferred Only	295.7 (182.7-408.6)	278.9 (126.6-431.2)	211.8 (101.6-322.1)	185.1 (107.0-263.2)	$F_{3, 65}$=1.00 p=0.40
Discharged Only	177.5 (152.1-203.0)	183.1 (148.6-217.6)	189.0 (158.6-219.3)	200.2 (164.0-236.3)	$F_{3, 168}$=0.40 p=0.75

Table J80. *MHSA Mean Patient Boarding Time in Minutes by Level of Poverty in Patient's ZIP Code (N=1,555,578)*

Visit Type	<5.0% (95% CI)	5.0-9.9% (95% CI)	10.0-19.9% (95% CI)	≥20% (95% CI)	Pearson
All Visit Types	253.9 (180.5-327.4)	292.7 (221.9-363.5)	248.8 (197.1-300.4)	306.1 (235.2-376.9)	$F_{3, 121}$=0.84 p=0.47
Admitted Only	162.6 (118.6-206.6)	267.8 (164.8-370.9)	351.9 (149.0-554.8)	347.5 (229.7-465.4)	$F_{3, 62}$=3.87 p=0.0134
Transferred Only	378.8 (288.9-468.8)	333.2 (136.7-529.7)	184.8 (104.6-265.0)	193.8 (98.1-289.6)	N/A**
Discharged Only	281.0 (146.5-415.6)	291.4 (191.5-391.3)	242.2 (183.7-300.8)	322.8 (211.0-434.6)	$F_{3, 96}$=0.59 p=0.62

**Unable to calculate due to one stratum with single sampling unit

Table J81. *Non-MHSA Mean Patient Boarding Time in Minutes by Level of Poverty in Patient's ZIP Code (N=10,974,151*)

Visit Type	<5.0% (95% CI)	5.0-9.9% (95% CI)	10.0-19.9% (95% CI)	≥20% (95% CI)	Pearson
All Visit Types	192.5 (151.9-233.2)	193.7 (161.1-226.2)	194.3 (163.1-225.5)	244.1 (174.2-314.0)	$F_{3, 168}$=0.94 p=0.42
Admitted Only	236.7 (149.5-323.8)	227.8 (171.3-284.3)	209.6 (148.8-270.3)	366.3 (179.3-553.2)	$F_{3, 138}$=2.45 p=0.07
Transferred Only	No reliable estimates available*				
Discharged Only	166.4 (141.2-191.7)	168.7 (130.2-207.1)	182.5 (149.5-215.5)	185.3 (149.0-221.6)	$F_{3, 166}$=0.46 p=0.71

*Unreliable: standard error >30% of estimate

Table J82. *Mean Patient Boarding Time in Minutes by the Urban-Rural Classification of the Patient's ZIP Code (N=12,850,438*)

Visit Type	Large Central Metro (95% CI)	Large Fringe Metro (95% CI)	Medium Metro (95% CI)	Small Metro (95% CI)	Non-Metro and Micro-politan (95% CI)	Pearson
All Visit Types	239.0 (181.2-296.8)	202.9 (168.6-237.1)	201.8 (177.3-226.4)	141.8 (108.7-174.8)	211.9 (140.6-283.2)	$F_{4, 168}$=3.25 p=0.0135
Admitted Only	304.2 (159.2-449.2)	202.1 (160.7-243.6)	235.8 (178.4-293.3)	149.6 (95.6-203.6)	279.9 (170.7-389.2)	$F_{4, 141}$=2.49 p=0.0456
Transferred Only	224.7 (144.2-305.1)	267.6* (70.4-464.8)	305.9 (170.5-441.3)	215.1* (9.9-420.4)	79.4 (34.3-124.5)	$F_{4, 64}$=4.54 p=0.0027
Discharged Only	200.4 (174.5-226.2)	199.5 (153.8-245.3)	172.7 (140.3-205.2)	133.2 (89.7-176.8)	187.1 (109.1-265.0)	$F_{4, 167}$=1.88 p=0.12

*Unreliable: standard error >30% of estimate

Table J83. *MHSA Mean Patient Boarding Time in Minutes by the Urban-Rural Classification of the Patient's ZIP Code (N=1,593,286*)

Visit Type	Large Central Metro (95% CI)	Large Fringe Metro (95% CI)	Medium Metro (95% CI)	Small Metro (95% CI)	Non-Metro and Micro-politan (95% CI)	Pearson
All Visit Types	339.4 (268.8-410.1)	229.6 (172.7-286.6)	291.3 (220.6-362.0)	241.2 (136.2-346.2)	136.3* (41.1-231.5)	$F_{4, 121}$=3.20 p=0.0154
Admitted Only	374.8 (235.5-514.1)	210.9 (139.0-282.8)	270.2 (182.3-358.1)	71.2* (-31.0-173.4)	160.2* (22.7-297.7)	$F_{4, 61}$=3.77 p=0.0083
Transferred Only	308.3 (191.2-425.4)	188.0* (67.8-308.2)	328.5 (178.0-479.0)	366.3* (102.4-630.1)	62.5* (21.3-103.8)	N/A**
Discharged Only	329.1 (230.0-428.3)	258.6 (159.5-357.6)	281.6 (185.0-378.1)	238.3 (124.5-352.1)	198.9* (25.7-372.1)	$F_{4, 97}$=0.62 p=0.65

*Unreliable: standard error >30% of estimate

**Unable to calculate due to one stratum with single sampling unit

Table J84. *Non-MHSA Mean Patient Boarding Time in Minutes by the Urban-Rural Classification of the Patient's ZIP Code (N=11,257,152)*

Visit Type	Large Central Metro (95% CI)	Large Fringe Metro (95% CI)	Medium Metro (95% CI)	Small Metro (95% CI)	Non-Metro and Micro-politan (95% CI)	Pearson
All Visit Types	223.4 (157.0-289.8)	199.2 (160.6-237.9)	188.9 (162.0-215.8)	132.6 (102.7-162.5)	221.4 (149.8-293.0)	$F_{4, 167}$=3.51 p=0.0088
Admitted Only	295.7 (136.0-455.5)	201.1 (155.8-246.4)	232.4 (170.3-294.5)	153.6 (98.9-208.4)	281.9 (171.1-392.6)	$F_{4, 138}$=2.07 p=0.09
Transferred Only	No reliable estimates available*					
Discharged Only	180.1 (155.5-204.8)	193.3 (140.6-246.1)	160.7 (129.9-191.5)	125.0 (87.2-162.8)	185.8 (105.2-266.3)	$F_{4, 165}$=1.72 p=0.15

*Unreliable: standard error >30% of estimate

Table J85. *Mean Patient Boarding Time in Minutes by Median Household Income in Patient's ZIP Code (N=12,530,431)*

Visit Type	≤$32,793 (95% CI)	$32,794-$40,626 (95% CI)	$40,627-$52,387 (95% CI)	≥$52,388 (95% CI)	Pearson
All Visit Types	233.8 (189.4-278.1)	225.6 (182.6-268.5)	201.1 (172.8-229.4)	192.6 (169.8-215.4)	$F_{3, 169}$=1.18 p=0.32
Admitted Only	310.0 (194.2-425.7)	261.7 (163.2-360.1)	224.6 (178.3-270.9)	218.4 (174.6-262.1)	$F_{3, 141}$=1.13 p=0.34
Transferred Only	140.7 (86.5-194.9)	234.9* (65.8-403.9)	335.2 (170.2-500.1)	289.0 (200.9-377.0)	$F_{3, 65}$=3.28 p=0.03
Discharged Only	200.3 (164.9-235.7)	201.1 (166.3-235.8)	177.6 (143.4-211.7)	172.9 (149.5-196.3)	$F_{3, 168}$=1.26 p=0.29

*Unreliable: standard error >30% of estimate

Table J86. *MHSA Mean Patient Boarding Time in Minutes by Median Household Income in Patient's ZIP Code (N=1,555,578)*

Visit Type	≤$32,793 (95% CI)	$32,794-$40,626 (95% CI)	$40,627-$52,387 (95% CI)	≥$52,388 (95% CI)	Pearson
All Visit Types	273.7 (209.2-338.3)	289.4 (209.3-369.4)	281.1 (214.7-347.5)	265.3 (201.9-328.7)	$F_{3, 121}$=0.09 p=0.96
Admitted Only	322.3 (205.7-438.9)	421.0 (206.0-635.9)	248.0 (144.6-351.4)	208.6 (133.3-284.0)	$F_{3, 62}$=1.69 p=0.18
Transferred Only	144.5 (83.6-205.3)	196.0 (80.1-312.0)	400.2 (190.8-609.7)	367.8 (274.5-461.1)	N/A**
Discharged Only	322.7 (221.5-424.0)	266.1 (179.1-353.1)	255.4 (179.7-331.0)	278.4 (174.9-381.9)	$F_{3, 96}$=0.46 p=0.71

**Unable to calculate due to one stratum with single sampling unit

Table J87. *Non-MHSA Mean Patient Boarding Time in Minutes by Median Household Income in Patient's ZIP Code (N=10,974,853)*

Visit Type	≤\$32,793 (95% CI)	\$32,794-\$40,626 (95% CI)	\$40,627-\$52,387 (95% CI)	≥\$52,388 (95% CI)	Pearson
All Visit Types	227.3 (176.1-278.4)	217.3 (170.1-264.5)	190.6 (158.2-223.0)	182.5 (158.6-206.4)	$F_{3, 168}$=1.12 p=0.34
Admitted Only	308.3 (177.6-439.1)	249.3 (143.2-355.5)	222.9 (173.7-272.1)	219.7 (171.5-268.0)	$F_{3, 138}$=1.03 p=0.38
Transferred Only	No reliable estimates available*				
Discharged Only	186.2 (150.2-222.2)	192.7 (157.6-227.9)	167.3 (128.7-205.9)	160.8 (139.1-182.5)	$F_{3, 166}$=1.45 p=0.23

*Unreliable: standard error >30% of estimate

Table J88. *Mean Patient Boarding Time in Minutes by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code (N=12,529,725)*

Visit Type	<12.84% (95% CI)	12.84%-19.66% (95% CI)	19.67%-31.68% (95% CI)	≥31.69% (95% CI)	Pearson
All Visit Types	233.5 (178.3-288.6)	233.1 (187.9-278.3)	203.4 (177.2-229.6)	182.4 (157.7-207.0)	$F_{3, 169}$=1.58 p=0.20
Admitted Only	306.4 (153.7-459.2)	276.1 (193.1-359.1)	235.9 (178.4-293.4)	190.8 (140.3-241.4)	$F_{3, 141}$=1.21 p=0.31
Transferred Only	245.5 (117.7-373.3)	215.9* (49.0-382.9)	189.2 (90.7-287.6)	252.5 (177.9-327.1)	$F_{3, 65}$=0.44 p=0.73
Discharged Only	192.5 (161.9-223.0)	203.2 (153.3-253.0)	184.2 (160.1-208.3)	173.5 (150.5-196.4)	$F_{3, 168}$=0.55 p=0.65

*Unreliable: standard error >30% of estimate

Table J89. *MHSA Mean Patient Boarding Time in Minutes by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code (N=1,554,872)*

Visit Type	<12.84% (95% CI)	12.84%-19.66% (95% CI)	19.67%-31.68% (95% CI)	≥31.69% (95% CI)	Pearson
All Visit Types	282.0 (219.7-344.3)	259.4 (166.9-351.9)	282.9 (204.5-361.2)	281.1 (218.9-343.4)	$F_{3, 121}$=0.07 p=0.98
Admitted Only	259.7 (159.0-360.4)	307.1 (193.2-421.0)	345.4 (197.9-493.2)	261.4 (105.7-417.1)	$F_{3, 61}$=0.31 p=0.82
Transferred Only	215.6 (117.0-314.2)	256.9* (6.2-507.6)	205.5* (81.0-330.0)	303.4 (219.0-387.9)	N/A**
Discharged Only	321.0 (223.8-418.2)	234.8 (162.8-370.8)	269.8 (168.8-370.8)	285.1 (198.5-371.7)	$F_{3, 96}$=1.24 p=0.30

*Unreliable: standard error >30% of estimate
**Unable to calculate due to one stratum with single sampling unit

Table J90. *Non-MHSA Mean Patient Boarding Time in Minutes by Percent of Adults with a Bachelor's Degree or Higher in Patient's ZIP Code (N=10,974,853)*

Visit Type	<12.84% (95% CI)	12.84%-19.66% (95% CI)	19.67%-31.68% (95% CI)	≥31.69% (95% CI)	Pearson
All Visit Types	226.3 (162.3-290.4)	229.8 (181.2-278.5)	193.2 (165.5-220.8)	165.9 (143.2-188.6)	$F_{3, 168}$=2.37 p=0.07
Admitted Only	310.7 (144.8-476.6)	273.5 (185.5-361.6)	224.8 (163.8-285.8)	180.9 (139.3-222.4)	$F_{3, 138}$=1.47 p=0.22
Transferred Only	No reliable estimates available*				
Discharged Only	175.7 (147.6-203.9)	199.9 (145.7-254.0)	174.1 (147.4-200.8)	158.2 (136.6-179.8)	$F_{3, 166}$=0.79 p=0.50

*Unreliable: standard error >30% of estimate

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