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Time to Medical Help-Seeking for Adults Who Experience Symptoms of Stroke in a California-Mexico Border Region

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Time to Medical Help-Seeking for Adults Who Experience Symptoms of Stroke in a California-Mexico Border Region

by

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DISSERTATION

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ABSTRACT

Background: Acute thrombolytic therapy for ischemic stroke must be administered within 4.5 hours of stroke symptom onset. Despite its proven efficacy fewer than 12% of those suffering acute ischemic stroke receive this treatment. The most common reason for low utilization is late medical help-seeking. Though the relationship among predictor variables and time to medical help-seeking have been explored in previous studies, it stills remains uncertain which predictors are most influential. The aim of this study was to identify factors associated with time to medical help-seeking for patients who experienced symptoms of stroke within a U.S. Southern California-Mexico border region. This study used Andersen and Newman's Individual Determinants of Health Service Utilization, a component of the Framework for Viewing Health Services Utilization, set within the context of Symptom Management Theory as its theoretical underpinnings.

Methods: A retrospective cohort study using Get With The Guidelines® Stroke and electronic health records of patients from a single health care organization with a discharge diagnosis of ischemic stroke between October 2018 and December 2019 was conducted. Data included ischemic stroke cases admitted to a hospital through one of four hospital emergency departments. A hierarchical linear regression analysis was performed to see what variables indicated a statistically significant association with delayed medical help-seeking.

Results: Of the total cases (N = 1052) discharged from the hospital with stroke, average age of 72 years and 25% Hispanic, 59% were considered delayed medical help-seekers. Regression analysis found a statistically significant association with late medical help-seeking and arriving by private vehicle (aOR 3.05, 95% CI, 2.27, 4.10), not having a

prior history of stroke or TIA (aOR 1.50, CI 95%, 1.14, 1.97), and being female (aOR 1.45, 95% CI, 1.12, 1.89). However, only 10% of variance in delayed medical help-seeking could be explained.

Conclusions: A majority of patients presenting to the hospital emergency department for symptoms of stroke were delayed medical help-seekers (> 4 hours from symptom onset). These patients arrived too late for first-line treatment with intravenous thrombolytics. It is necessary to identify those at risk for delayed medical help-seeking in order to decrease stroke mortality and long-term disabilities.

DEDICATION

The writing of this dissertation was completed during one of the most tempestuous times in recent history. An ongoing global pandemic that, to date, has claimed the lives of over 500,000 Americans and over 3 million people worldwide. This unnecessary loss of life is something that should not be forgotten. Health care providers and others providing critical ancillary services not only risked their lives to care for those inflicted by the COVID-19 virus, bud did so at the expense of their lives. To all those heroes who have worked and are working the frontlines during this pandemic, I express my gratitude through the dedication of this dissertation.

ACKNOWLEDGEMENTS

I wish to thank my dissertation committee chair, Dr. Mary Barger, and my committee members Drs. Ruth Bush and Brenda Boone. When I first considered who to ask to serve on my dissertation committee, I asked these faulty members because I respected their in-depth knowledge and expertise. I had no idea of where their commitment and guidance was going to lead me. In the end, I realized the enormity of luck I had when they agreed to serve on my committee. Their feedback was paramount in assisting me through the completion of this study and dissertation manuscript. For this, I am forever grateful.

My family and especially my children deserve to be acknowledged for the love and support they provided throughout my entire educational pursuit and the sacrifices they endured while I was getting here.

I also wish to express my gratitude for my friends, colleagues, and PhD cohort. My friends, especially Rosa, Zdravka, and Jenna have been an unrelenting source of support, and without them I don't think this process would be possible. My work colleagues were not only supportive of my educational pursuit, but they were my cheerleaders, supporting and believing in me and seeing this journey to its end. Also, my PhD cohort, once a group of strangers who came together on that first Thursday of class and with whom I got to enjoy my Thursday's with for the next three years. Each one brought different perspectives, expertise, and strengths to the classroom and were a never-ending source of knowledge. I also wish to acknowledge all those who touched my life in one way or another, including all of the many professors and educators I had throughout my educational journey and from whom I've learn so much.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter I

The time interval between symptom onset and definitive medical treatment, referred to as *time to medical help-seeking*, is critical to long-term outcomes, especially for victims of stroke. Disability and death resulting from delayed medical help-seeking in stroke can be devastating. Time to medical help-seeking comprises that interval from one's primary symptom experience, e.g., initial perception of a somatic change, to the time definitive medical help is reached. Yet only about one-third of people experiencing symptoms of stroke seek medical treatment within the first few hours of symptom onset (Kim et al., 2017).

Initial medical treatment for stroke is time sensitive and the administration of intravenous alteplase, the only U.S. Food and Drug Administration (FDA) approved drug for treatment of ischemic stroke, must be initiated within the first 4.5 hours of stroke symptom onset (Bluhmki et al., 2009; Hacke et al., 2008; Hacke et al., 1998; Lees et al., 2010). Prompt medical help-seeking leads to early medical attention, timely treatment, and improved functional outcomes for those experiencing stroke (Kim et al., 2017; Saver et al., 2013). Unfortunately, by delaying medical help-seeking stroke victims arrive to the hospital too late to receive acute treatment with alteplase and injury resulting from stroke cannot be averted. To improve acute stroke treatment rates and decrease stroke related morbidity and mortality, health care practitioners must understand factors affecting the timeliness of individuals in seeking medical treatment for symptoms of stroke.

For those who experience stroke symptoms, known time of symptom onset is essential, as it dictates initial medical management. People who arrive to the hospital within 4 hours of symptom onset may still have time to be evaluated and deemed eligible

for initial treatment with intravenous alteplase. Alteplase must be initiated within 4.5 hours of stroke symptom onset to be beneficial (Bluhmki et al., 2009). After 4.5 hours, the benefit of administering alteplase does not outweigh associated risks; therefore, early medical help-seeking is advantageous and critical in the management of stroke. To understand those factors influencing one's decision for early medical help-seeking, e.g., arriving to the hospital within 4 hours of stroke symptom onset, versus one's decision to delay medical help-seeking, e.g., arriving to the hospital greater than 4 hours after stroke symptom onset, data from those who experienced ischemic stroke were collected and analyzed.

Background and Significance

Over the last decade, death from stroke has declined (Benjamin et al., 2019).Yet, long-term, severe disability has increased. Stroke is the 3rd leading cause of death for females and the 5th leading cause of death for males in the U.S. (National Center for Health Statistics, 2018). Further, stroke is the leading cause of long-term, serious disabilities. Initial medical treatment for acute stroke is time sensitive, with timely medical treatment leading to improved symptom status, improved functional status, increased quality of life, and decreased morbidity and mortality (Kim et al., 2017).

Though treatment with intravenous alteplase for acute ischemic stroke was approved by the FDA in 1996, only about 12% of those suffering an acute ischemic stroke receive it (Zoler, 2019). There are several reasons why an individual, who may otherwise be eligible in regards to treatment time, would not receive treatment with alteplase. A few of these reasons include someone suffering a hemorrhagic stroke, or experiencing active internal bleeding, or someone who has had recent major surgery

(American Heart Association [AHA] Stroke Council and Council on Epidemiology and Prevention, 2015). Messé et al. (2016) found of those patients who arrived within 2 hours of stroke symptom onset and who did not receive alteplase treatment, 65% had documented contraindications. Of those with documented contraindications, the most frequently cited reasons included: improved or improving symptoms prior to medical intervention (51%), too elderly (7%), declined treatment (6%), ineligible after initial radiographic imaging as a result of cerebral bleed or other disqualifying imaging findings (6%), and abnormal laboratory values (5%). Of note, only 16% of all stroke victims in the study arrived at the hospital under 2 hours. Consequently, the overall primary reason for low treatment rates with alteplase for ischemic stroke was a result of delayed medical help-seeking (Hjelmblink et al., 2010; Messé et al., 2016; Reynolds & Ward, 2014; Schwamm et al., 2013).

Since approval of alteplase for use in the treatment of acute ischemic stroke, time to medical help-seeking for those experiencing symptoms of stroke has been the subject of inquiry and critical discourse (Mellon et al., 2016; Moser et al., 2006; Rosamond et al., 1998; Zerwic et al., 2007). As a result of the time-dependent nature of alteplase, it is essential for those experiencing symptoms of stroke to seek medical treatment immediately in an effort to expedite medical care and improve symptom status and outcomes (Kim et al., 2017). With nearly 795,000 people in the U.S. experiencing stroke annually and an annual estimated direct cost of $34 billion, earlier medical treatment may lead to increased quality of life and decreased morbidity, and reduced costs (Benjamin et al., 2019; National Center for Health Statistics, 2018). Identifying factors influencing patients' decisions to seek timely medical treatment for symptoms of stroke allows health

care professionals to better identify individuals at risk for delayed medical help-seeking. Thereby, improving the health care community's ability to identify and establish early medical plans for at-risk individuals, to develop evidence-based interventions and strategies, and direct appropriate educational efforts at the community level.

Statement of the Problem

Medical help-seeking is a symptom management strategy that has a direct impact on symptom status outcomes, e.g., functional status, quality of life, comorbidities, and morbidity (Humphreys et al., 2014). By engaging in other symptom self-management strategies prior to medical help-seeking for symptoms of stroke, one may delay critical and necessary medical treatment (Humphreys et al., 2014; Leventhal et al., 2016). Previous studies have explored reasons for delayed medical help-seeking in stroke, as well as the relationship among predictor variables and timeliness of medical help-seeking. However, not only do the relationships among predictor variables and time to medical help-seeking remain uncertain, but stroke literature demonstrates conflicting evidence on why people delay medical help-seeking (Madsen et al., 2016; Moser et al., 2006; Teuschl & Brainin, 2010; Springer et al., 2017; Zerwic et al., 2007). Presently, predictor variables most influential or essential to early medical help-seeking remain uncertain. Moreover, few studies have considered factors related to patient delays for medical help-seeking in those suffering stroke in the U.S.; and no studies have examined reasons for delayed medical help-seeking for stroke in a U.S. border county; specifically, a county neighboring the U.S.-Mexico border.

Furthermore, published studies focused on timeliness of medical help-seeking for symptoms of stroke have utilize different time-interval outcomes. Consequently, there is

no consistency in the literature on what is *early* medical help-seeking versus *delayed* medical help-seeking for symptoms of stroke. Some studies have considered time intervals from initial stroke symptom onset to 2-hours to hospital arrival as early help-seeking, while others have considered a 3-hour or 6-hour interval. A short time interval such as 2 hours from symptom onset includes only a small percentage of those suffering from stroke who may be eligible for first-line treatment with alteplase. Whereas time intervals up to 6 hours from symptom onset includes subjects who may be eligible for secondary treatments but would not be eligible for alteplase as a first-line treatment.

For the purpose of this study, a 4-hour time interval from symptom onset to medical help-seeking was used to identify those variables influencing *early* medical help-seeking (those who arrive within 4 hours of symptom onset) versus *delayed* medical help-seeking (those who arrive after 4 hours of symptom onset). Using this time interval allowed for inclusion of all cases potentially eligible for first-line treatment with intravenous alteplase. It also allowed for the identification of those ineligible for treatment with alteplase. If a person arrives to the hospital within 4 hours of symptom onset, the medical practitioner still has time to evaluate the patient for first-line treatment with alteplase, as alteplase can be initiated up to 4.5 hours from symptom onset.

Purpose of the Study

The purpose of this study was to examine relationships among selected sociodemographic variables (age, gender, race/ethnicity), medical insurance status and type, mode of hospital transportation, medical history, symptom presentation and the association with increased likelihood of delayed medical help-seeking for symptoms of

stroke in those who sought medical treatment at a comprehensive health care organization located within a U.S. Southern California-Mexico border region.

This study included a retrospective cohort of cases discharged with a diagnosis of ischemic stroke from a comprehensive health care organization in Southern California. Data were stored in a national data repository and electronic health records. According to Hulley and colleagues (2013), a primary purpose of this type of study is analysis. That is, describing an association, if any, among the independent variables and the dependent variable. Benefits of a retrospective cohort study includes efficiency and cost effectiveness. In a retrospective cohort study, the researcher has the advantage of utilizing pre-collected data from a specific population without the laborious task of on-going follow up. This study design method was appropriate for this study, as it allowed for the use of multiple variables from a large cohort of cases diagnosed with ischemic stroke, which were already a part of an existing database.

Research Question

Do demographic variables (age, gender, race/ethnicity), medical insurance status and type, mode of hospital transportation, medical history, and symptom presentation influence the likelihood of delayed medical help-seeking for symptoms of stroke; and which variables have the most influence on timeliness of medical help-seeking?

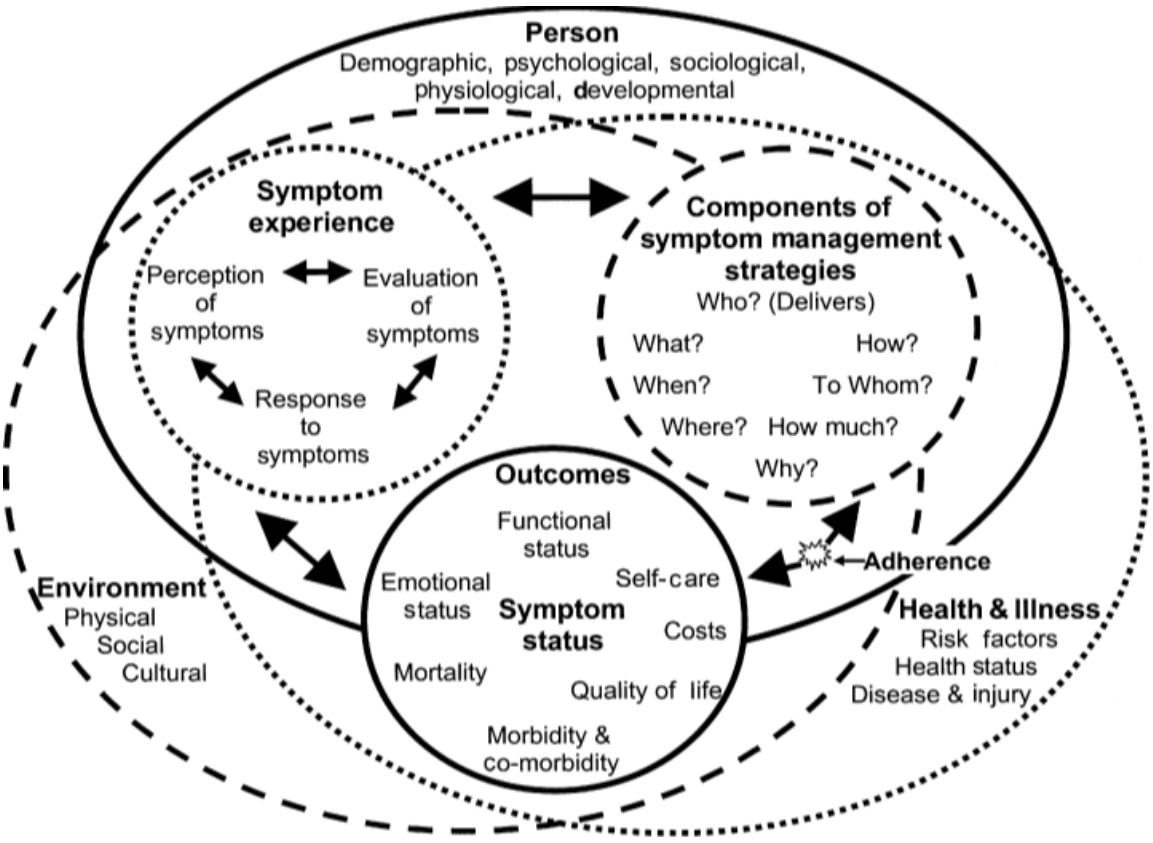
Theoretical Model

Medical help-seeking is a conceptual element of *symptom management strategies* within the Symptom Management Theory (SMT) and includes the use of health services (Andersen, 1995; Dodd et al., 2001; Humphreys et al., 2014). Help-seeking behavior is influenced by a variety of complex, multifactorial dynamics, which may impact and be

impacted by *symptom experience*, an essential element of the SMT (Dodd et al., 2001; Humphreys et al., 2014). Additionally, a complex, bi-directional relationship exists between symptom experience and symptom management strategies, which may influence time to medical help-seeking and ultimately symptom outcomes. As such, the SMT was the theoretical underpinning used to guide this study (see Figure 1).

Figure 1

Theoretical Model



Note. From "Revised Symptom Management Conceptual Model," Dodd et al., (2001). Advancing the science of symptom management. *Journal of Advanced Nursing, 33*(5), p. 670. Copyright 2008 by John Wiley and Sons. Reprinted with permission.

The SMT is a middle-range nursing theory initially developed by nurse researchers at the University of California, San Francisco for the purpose of creating a general symptom management model that could be used across a variety of different settings and purposes (UCSF School of Nursing Symptom Management Group [UCSF], 1994). Additionally, the model was conceived with a purpose of being able to integrate a multitude of diseases and associated symptoms. Unlike other models created to capture specific aspects of symptom management, this model was designed to embrace the entire symptom management experience—symptom experience, symptom management strategies, and symptom outcomes. Furthermore, since it is within nursing's domain to collaborate with patients to develop effective symptom management strategies with a goal of controlling symptoms and ultimately improving symptom outcomes, the model was constructed to assist nurses and their patients in this effort.

Accordingly, subsequent revisions of the model have incorporated the three domains of nursing science (person, health and illness, and environment) as contextual variables influencing the model's essential concepts (Dodd et al., 2001; Humphreys et al., 2014). Since the original publishing of the SMT, clinicians and researchers have continued to use it to guide practice and research and have participated in its continued development and significance (Dodd et al., 2001). According to SMT, help-seeking is an iterative process of symptom management initiated by the symptom experience (Dodd et al., 2001; UCSF, 1994; Humphreys et al., 2014). Symptom experience may include one's perception of symptoms as well as the perceived significance of symptoms. Significance may be influenced by multiple factors such as prior experience, knowledge, or available resources. Additionally, once significance is placed on symptoms, a decision to respond

in one way or another must be made (Dodd et al., 2001; UCSF, 1994; Leventhal et al., 2016; Humphreys et al., 2014). If medical help-seeking is not a priority, then response time to help-seeking will be delayed. Accordingly, multiple contextual elements may affect one's symptom response. Those elements mirror the elements lain within the domains of nursing science; those in which symptom management is situated (Dodd et al., 2001; Humphreys et al., 2014). Specifically, person, health and illness, and environment. Hence, understanding those elements affecting medical help-seeking decisions allow nurses to better influence symptom response, timeliness to medical help-seeking, and ultimately symptom outcomes for those experiencing stroke.

Specific Aims

1. To assess the strength of association among demographic characteristics, medical health insurance and type, medical history, symptom presentation, and mode of transportation to the hospital for early medical help-seekers and delayed medical help-seekers.
2. Determine whether any select demographic characteristics, medical insurance status and type, medical history, symptom presentation, and mode of transportation to the hospital are associated with the likelihood of being a delayed medical help-seeker.

Summary

Early medical help-seeking can lead to increased treatment options and improved functional outcomes in those experiencing symptoms of stroke. Conversely, delayed medical help-seeking can lead to exclusion of potentially beneficial therapy and increase the odds of experiencing a poor functional outcome for those experiencing symptoms of

stroke. This study sought to improve understanding of variables influencing delayed medical help-seeking behavior among those seeking medical care for symptoms of stroke within a U.S. Southern California-Mexico border region.

Chapter II

Review of the Literature

This chapter presents a review of the literature relevant to the relationship among research variables and medical help-seeking. An initial discussion of the study's conceptual framework and integration within the SMT is presented. The conceptual framework defines a predicted relationship among independent variables and the dependent variable *use of health care services*—further defined as *time to medical help-seeking*. Research variables are integrated throughout the conceptual framework and summarized at the end of this chapter.

Conceptual Framework

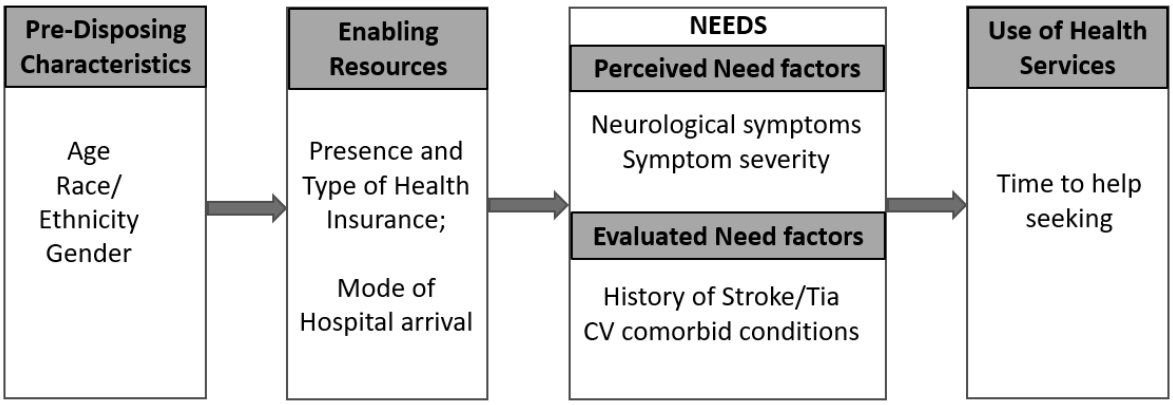
An adaptation of Andersen and Newman's Individual Determinants of Health Service Utilization (HSU), a component of the Framework for Viewing Health Services Utilization was the conceptual framework for this study (see Figure 2). The HSU is the behavioral component of the larger framework and is used to explain individual determinants facilitating or impeding utilization of health care services (Andersen & Newman, 2005). Within the HSU, individual requisites of medical help-seeking include predisposing characteristics, enabling resources, and evaluation of needs (Andersen, 1995; Andersen & Newman, 2005). These too are conditions nested within the domains of nursing science and the overall SMT (Humphreys et al., 2014).

According to Andersen and Newman, a person's individual use of health care services is influenced by three factors: predisposing factors, enabling factors, and need factors (Andersen, 1995; Andersen & Newman, 2005). Pre-disposing factors include a person's social structure; for instance, education, culture, and health beliefs, including

attitudes towards and knowledge of the health care organization, and demographic variables such as age, race, and gender. For the purpose of this study, age, race/ethnicity, and gender exemplified pre-disposing factors. The reason for this choice was due to the study design and limitations of data availability.

Figure 2

Conceptual Framework



Note. Adapted from "Individual Determinants of Health Service Utilization," a component of Andersen and Newman's Framework for Viewing Health Services Utilization. Andersen & Newman (2005). Societal and individual determinants of medical care utilization in the United States [PDF]. *The Milbank Quarterly, 83*(4), p. 14. (Reprinted from *The Milbank Memorial Fund Quarterly: Health and Society*, *51*[1] [1973], p. 95-124. https://pdfs.semanticscholar.org/04ab/38ff3a0d7dd654c8b8b2094bd6e1f6805be7.pdf).

Enabling factors of the HSU include those resources affecting the planning and performance of obtaining health care. This includes personal and family related factors such as income, health insurance, transportation, and knowledge of health care access as

well as community factors such as accessible health care facilities (Andersen, 1995; Andersen & Newman, 2005). For the purpose of this study, medical health insurance and mode of transportation to the emergency department (ED) served as enabling factors.

Further, medical health insurance served as a determinant for two independent variables. The first variable considered whether a case had or did not have health insurance. Whereas the second variable considered the type of health insurance. Type of medical health insurance served as a proxy for socioeconomic status (SES). Type of insurance is further elaborated on in the Methods section of chapter 3.

Both pre-disposing and enabling factors are elements within the domain of nursing science; specifically, that of person and environment. As such, they are critical elements for nurses and other health care practitioners to consider when implementing strategies directed at improving stroke treatment rates. For instance, without a means of transportation or with concerns of how to pay medical costs, one may delay seeking medical care for otherwise series symptoms, including symptoms of stroke.

Additionally, the HSU component of the larger framework consists of *need factors*. Need factors reflect those elements positioned within the health and illness domain of nursing science and encompasses the sphere of symptom experience. These factors directly influence an individual's decision to seek immediate medical evaluation and results in timely medical help-seeking. Accordingly, the SMT considers adherence to symptom management strategies as directly influencing symptom status and functional outcomes (Humphreys et al., 2014).

Need factors are further subdivided into *perceived needs* and *evaluated needs*. According to Andersen & Newman (2005), perceived need is the most influential

component of medical help-seeking. Perceived need includes one's perception of symptom severity. Additionally, perceived need considers an individual's symptom experience (what is going on) and significance put on it at the time medical help is sought. Whereas, evaluated need—typically considered the domain of the health care provider—results in one's motivation for seeking medical help. For instance, it is within one's purview to evaluate the need for medical help-seeking within the context of prior symptom experiences, current health status, and known disease states.

Inclusively, this study comprised of pre-disposing characteristics of health care utilization: age, race/ethnicity, and gender; as well as enabling resources: health insurance status, type of health insurance, and mode of transportation to the hospital—emergency medical services or private transportation from home or scene of symptom onset to the ED. Additionally, the study included factors related to *perceived need,* including neurological symptoms and symptom severity, as well as factors related to *evaluated need* including a past medical history of stroke or transient ischemic attack and current presence of other cardiovascular comorbid conditions. In relation to this study's conceptual framework, the outcome variable, *time to medical help-seeking*, served as a proxy for use of health services.

Literature Review

Stroke

Stroke is a clinical syndrome that broadly references two different types of cerebral insults, an ischemic insult and a hemorrhagic insult (Powers et al., 2019). Ischemic insults, or injuries, make up most strokes. Ischemic strokes are approximately 87% of all strokes, whereas hemorrhagic strokes are approximately 13% of all strokes

(Benjamin et al., 2019). While timely medical care is critical for both types of strokes, this study focused on ischemic strokes.

An ischemic stroke occurs when there is an interruption to cerebral blood flow that results in infarction of cerebral tissue (Powers et al., 2019). Most ischemic strokes are caused by either a cerebral artery blood clot, which occurs at the site of the blockage (thrombus) or a blood clot that has originated in another part of the body and traveled through the arterial system and into the cerebral circulation (embolus). When blood flow to brain tissue is interrupted, regardless of whether it is a result of a thrombus or an embolus, nutrients and oxygen can no longer be delivered to the area perfused by the blocked artery and tissue injury at the cellular level begins to occur. If blood flow is not quickly restored, tissue death will eventually start to occur. A cerebral artery blockage with subsequent surrounding tissue death is referred to as an ischemic stroke or stroke.

Thrombolytic Usage in Stroke

In 1996, with the FDA's approval of alteplase in the treatment of acute ischemic stroke, alteplase became the first-line treatment for stroke (Genentech, 1996). This continues to hold true 25 years later. However, the FDA's approval came with a time requisite. Alteplase for acute ischemic stroke had to be administered within 3 hours of stroke symptom onset. Since initial approval and use of alteplase for stroke, several studies have demonstrated benefit with alteplase if administered within 4 ½ hours of stroke symptom onset (Lees, 2010; Hacke et al., 2008; Hacke et al., 1998). Additionally, use of alteplase up to 4 ½ hours from stroke symptom onset is integrated into the national clinical practice guidelines put forth by the American Heart Association Stroke Council

(Powers et al., 2019). These are also the standard guidelines utilized by the health care organization whose data were utilized for this study.

Predisposing Factors

Predisposing factors, those positioned within the nursing domains of *person*, such as age, race/ethnicity, and gender influence all spheres of one's symptom management experience (Andersen & Newman, 2005; Humphreys et al., 2014). During research, demographic variables are collected by the researcher and used to describe study participants but may not always be used in the final analysis to understand the influence they may have on an outcome variable. Yet, in other circumstances it may be critical to understand what type of influence demographic variables have on an outcome variable. Such is the case with *time to medical help-seeking* in stroke. Several studies have demonstrated a significant influence on timeliness to medical help-seeking based on certain demographic variables. Therefore, the influence of demographic variables on time to medical help-seeking are considered in this section.

Age

Stroke occurs most often in older adults and one's risk increases with age, putting the highest risk burden for stroke on the most elderly (Barker-Collo et al., 2015; Benjamin et al., 2019). However, there is also evidence that some ethnic groups may be more vulnerable to stroke at a younger age than other groups. For example, Morgenstern et al. (2004) found a higher cumulative incidence of stroke in Mexican Americans compared to non-Hispanic Whites (145 versus 121 per 10,000, respectively) for those aged 45 years and older. They also found higher risk ratios for stroke based on age in Mexican Americans compared to non-Hispanic Whites. For instance, Mexican Americans

aged 45 to 59 years had a risk ratio of 2.07 (95% CI 1.57, 2.73) when compared to non-Hispanic Whites, and this higher risk ratio for stroke persisted across all adult age groups for Mexican Americans.

Further, some studies found age to influence one's time to medical help-seeking; however, this has not been consistent across all studies. For instance, Gargano et al. (2011) found that the youngest and oldest stroke victims tended to arrive later than other age groups with only 14.8% of those under 50 and 17.1% of those over 80 years of age arriving within 2 hours of symptom onset. This compares to 20% or more of those between 50 and 79 years of age who arrived within 2 hours. Though this difference was not statistically significant, it may help establish whether there is a trend between age and time to medical help-seeking. When Gargano et al. (2011) adjusted their analysis for specific covariates they found a significant quadratic relationship between early medical help-seeking and age. They found that those who were 85 years old (aOR 0.7, 95% CI, 0.5, 0.9) and those who were 95 years old (aOR 0.4, 95% CI, 0.3, 0.8), when compared to those who were 65 years old, were less likely to seek medical care within 2 hours of symptom onset. In another study, conducted by Lacy et al. (2001), the researchers found that those between the age of 65 and 74 years had lower adjusted odds of arriving to the hospital within 3 hours from symptom onset compared to those 55 years of age of less (aOR 0.41, 95% CI, 0.1, 0.96). Other age groups did not have statistically different odds.

Eleonora et al. (2013) also found a statistically significant difference ($p < .001$) in age with those who were younger seeking care in less than 2 hours from symptom onset compared to those who were older. Though the difference in mean age was small and the population relatively older, mean age 72.1 $\pm$ 14.7, versus a mean age of 75.0 $\pm$ 13.3,

respectively. The researchers also found that in those over 80 years of age 31.7% sought care in under 2 hours, $p < .001$ (Eleonora et al., 2013). This is a much larger percentage than what Gargano and colleagues found. A possible explanation is that the two studies were done in different countries where the health care and social structures may differ quite a bit. Gargano et al. (2011) conducted their study in Michigan, U.S., and Eleonora et al. (2013) conducted their study in Florence, Italy. Moreover, Rossnagel et al. (2004), looked at age as a continuous variable and using the multivariate Cox proportional hazards model for out of hospital delay, found that as age increased there was an associated decrease in time to hospital arrival (adjusted hazard ratio 0.99, 95% CI, 0.98, 0.99).

Further, in a multivariate analysis of factors related to prehospital delay, Faiz et al. (2012) found younger age to be significantly associated with earlier arrival (p=.048). In contrast, many other studies have not found age to be a significate factor influencing time to medical help-seeking (Azzimondi et al., 1997; Kim et al., 2011; Springer et al., 2017; Turan et al., 2005). A couple explanations for these mixed results on how age affects time to hospital arrival is that most of the studies used different categories for age; also, some used age as a continuous measure while others used it as an ordinal measure.

Race/Ethnicity

Studies have demonstrated differences in medical care, health outcomes, and stroke burden related to race/ethnicity (Morgenstern et al., 2004; Schwamm et al., 2010). Additionally, studies have looked at race/ethnicity in regards to health care utilization, timeliness of health care utilization, health equity, and disease burden (Balfour et al., 2015; Rooks et al., 2002; Springer et al., 2017). For example, a study conducted in 10

different hospitals in New Jersey found that Black patients were less likely to arrive to the hospital within 3 hours from stroke symptom onset compared to White patients ($p = .038$; Lacy et al.,2001).

Furthermore, according to Smith et al. (2010), Mexican Americans were less likely to utilize hospital transportation by emergency medical services (EMS) for symptoms of stroke. This was similar to findings by Springer et al. (2017), who found that both Hispanics and Blacks were less likely to use EMS transportation for symptoms of stroke ($p = .001$ and $p = .003$, respectively). Likewise, after adjusting for other patient characteristics, Mochari-Greenberger et al. (2015) found that Hispanic men had the lowest odds of using EMS (aOR 0.77, 95% CI, 0.73, 0.80) compared to all other groups. Asian men also had lower odds of using EMS compared to White men (aOR 0.80, 95% CI, 0.75, 0.85); whereas the use of EMS among Black males was similar (aOR 1.00, 95% CI, 0.96, 1.03) to rates among White males (Mochari-Greenberger et al., 2015). Additionally, Black, Hispanic, and Asian females all had significantly lower odds of utilizing EMS for symptoms of stroke compared to White females, who were the highest utilizers of EMS for stroke symptoms (Mochari-Greenberger et al., 2015). Further, Lacy et al. (2001) found significant differences in use of EMS between White patients and other race/ethnic groups, including Black ($p = .005$), Asian ($p = .042$), and Hispanic ($p = .042$) patients. Whereas other race/ethnic groups were less likely to utilize EMS for hospital arrival compared to Whites.

Consequently, further studies have established that EMS transport significantly reduces time to medical help-seeking for patients suffering a stroke (Faiz et al., 2012; Kim et al., 2011; Madsen et al., 2016). Thus, by not utilizing available and necessary

medical resources such as EMS, time to medical help-seeking is further delayed, possibly making those patients ineligible for acute stroke treatment once medical care is reached.

Gender

More women suffer stroke than men as a result of their increased longevity, whereas age-specific incidence of stroke is greater in men than in women (Barker-Collo et al., 2015). Women also tend to have more severe strokes, to be older when they experience stroke, and to have a lower alteplase treatment rates compared to men (de Ridder et al., 2013; Haki et al., 2020; Madsen et al., 2016; Mainz et al., 2020). In addition, some studies show that women tend to present to the hospital later than men (Haki et al., 2020; Mainz et al., 2020; Smith et al., 2010). Though, this finding is generally not consistent.

In examining the difference in treatment rates among women and men, de Ridder et al. (2013) analyzed the records of 5,515 patients who presented to the hospital with stroke. They found on average women were 4 years older than men and 41% of the female population was over the age of 80 compared with only 22% of the male population. They also found fewer women than men sought medical help within 4 hours (27% and 33%, respectively), and only 11% of women versus 14% of men received alteplase treatment for stroke. Even with adjustment for age, alteplase treatment rates continued to be lower for females than for males (aOR 0.8, 95% CI, 0.7, 1.0; de Ridder et al., 2013).

In another study conducted at 10 hospitals in New Jersey, the researchers did not find a statistically significant difference in age between men and women who arrived to the hospitals within 3 hours; however, they did find a statistically significate difference in

women being more likely to arrive to the hospital in under 6 hours compared to men in their study (*p* .038; Lacy et al., 2001). Likewise, several other studies found no difference in gender and arrival times after adjusting for other covariates (Faiz et al., 2012; Madsen et al., 2016; Morris et al., 2000; Turan et al., 2005).

In contrast, Mainz et al. (2020), examined the records of 5,356 from a nationwide public registry in Denmark and found that in general women delayed hospital arrival, with a median arrival time from symptom onset of 200 minutes, when compared to men, with a median arrival time from symptom onset of 180 minutes. Additionally, a study performed at a Turkish hospital by Haki et al. (2020), found that women had a 2.21 greater risk of late hospital arrival compared to men ($p = .009$).

Further, Smith et al. (2010) also found a significant difference in time to hospital arrival for women compared to men. This study included 1,134 patients in Southern Texas who sought care for ischemic stroke. The researchers concluded women were less likely to seek care than men within 3 hours of symptom onset (aOR 0.7, 95% CI, .05, .09). Only 25% of women in the study sought care within 3 hours compared to 31% of men. However, on further observation based on race, the only significant difference was in Hispanic women who were less likely to seek care within 3 hours compared to Hispanic men ($p = .029$).

Enabling Factors

Situated within the nursing science domains of environment and person, enabling factors include those resources that must exist for one to utilize health services. For one to strategize the most appropriate components of symptom management, they must have access to proper resources. These resources are considered enabling factors, which

include both community resources and personal resources (Andersen, 1995). Such things as accessible health care facilities and care providers, as well as personal resources such as income, medical insurance, and transportation are all enabling factors. Without access to necessary resources, symptom management strategies are limited. For example, a study conducted in South India assessing reasons for medical management delays revealed that stroke patients are required to pay up front for treatment with alteplase (Abraham et al., 2017). Without the means to pay for this critical first-line treatment, patients go without it, even though it is a proven disease-management strategy. As such, this appears to be a particular issue for those in developing nations with limited resources. Enabling factors used in this study included medical insurance and mode of hospital transportation.

Medical Insurance

Medical insurance is an enabling resource of health service utilization in the U.S. This resource nests within the nursing domains of person and environment and influences all spheres of the symptom management theory (Andersen, 1995; Andersen & Newman, 2005; Dodd et al., 2001; Humphreys et al., 2014). Medical insurance may also be used as a surrogate for SES (Ayanian et al., 1993; Foraker et al., 2010; Medford-Davis et al., 2016).

Research demonstrates variation in health service use based on insurance coverage and type. For example, Meisel et al. (2011) looked at a sample of national data to investigate the association among the use of EMS and type of health insurance. The researchers concluded that those who were uninsured or those insured under Medicaid had a higher adjusted odd (aOR 1.43, 99% CI, 1.28, 1.60; aOR 1.60, 99% CI, 1.43, 1.80, respectively) of arriving to the hospital by EMS compared to those with private

insurance. In another study conducted by Smith et al. (2018) using a survey on Amazon Mechanical Turk, the researchers found that 68.8% of respondents who were uninsured indicated that they have delayed or avoided medical care use versus 41.1% of those respondents who were insured ($p < .001$). Amazon Mechanical Turk is a statistically validated website where researchers can post surveys and participants can answer them for a small stipend (Casler et al., 2013).

Likewise, Smolderen et al. (2010) looked at how insurance status and financial concerns affected emergency medical care seeking for victims suffering an acute myocardial infarction. In this study, the researchers found that there were significant differences in time to medical help-seeking based on insurance status ($p < .001$). The researchers categorized 3,721cases into one of three groups: those with insurance and without financial concerns, those with insurance and with financial concerns, and those without insurance. Those with insurance and without financial concerns were more likely to seek emergency medical care within 2 hours of symptoms onset (36.6%); whereas 33.5% of those with insurance and financial concerns, and 27.5% of those without insurance sought emergency medical care within 2 hours of symptom onset. This difference remained statistically significant after controlling for several other factors, including demographics, symptoms, baseline health, and comorbidities. When compared to those with insurance and without financial concerns, those with insurance and financial concerns had a greater likelihood of delaying medical help-seeking (aOR 1.21, 95% CI, 1.05, 1.41) as did those without insurance (aOR 1.38, 95% CI, 1.17, 1.63). According to the researchers, their findings are in alignment with other study findings looking at

insurance status and emergency treatment for acute myocardial infarction (Smolderen et al., 2010).

Similarly, Medford-Davis et al. (2016), looked at the effects of insurance status on health outcomes. In their study, those who were uninsured were less likely to use EMS for hospital transport for symptoms of stroke and tended to arrive to the hospital later than those with Medicare or Medicaid coverage. Only 35.71% of those uninsured utilized EMS, versus 43.87% of Medicare patients and 44.99% of Medicaid patients (Medford-Davis et al., 2016).

Conversely, Lacy et al. (2001) also investigated the effect of having medical insurance or no medical insurance and type of medical insurance on the use of EMS for symptoms of stroke. The researchers concluded not having medical insurance did not significantly affect whether someone used EMS (aOR 2.23, 95% CI, 0.85, 5.86), in the population they studied. They did, however, find having commercial insurance or an HMO demonstrated a significant increase in the likelihood of utilizing EMS. Though, once adjusted for other covariates this finding was no longer statistically significant. Additionally, the number of participants with commercial insurance and HMO coverage were too low to make any kind of inference (n=10, n=16, respectively; Lacy et al., 2001).

In another study of stroke victims, the relationship among insurance status and time to medical help-seeking was analyzed (Gargano et al., 2011). In this study, however, no significant relationship among insurance status and time to medical help-seeking was established (Gargano et al., 2011).

Overall, in a large majority of stroke related studies looking at delays in medical care seeking, medical insurance status was not used as a study variable. Thus, little is

known about how insurance coverage and type of insurance affect the timeliness in seeking medical care for symptoms of stroke.

Moreover, in addition to looking at the effect of having medical insurance on time to medical help-seeking, medical insurance has been used as a surrogate for SES in prior studies. This is specifically true for Medicaid, as it is a needs-based insurance linked to federal poverty guidelines (Casey et al., 2018; Kaiser Family Foundation, 2019). For instance, Foraker et al. (2010) used both census tract-level neighborhood income and Medicaid coverage as proxies for SES to examine the association among SES and the practice of evidenced-based medical treatment in patients suffering from acute myocardial infarction.

Additionally, Casey et al. (2018) studied the association between conventional measures of SES and Medicaid. The researchers concluded insurance, specifically Medicaid, was an imperfect but useful tool for considering SES and that any single indicator of SES is likely to fail to embrace the complexity and entirety of actual SES (Casey et al., 2018). However, with the increasing use of medical records to collect and analyze health data and limited information about SES in medical records, using insurance as a surrogate for SES is becoming more common (Casey et al., 2018). In addition, Casey et al. (2018) warns that when using insurance as a measure of SES, researchers should use caution when attempting to make any inferences (Casey et al., 2018).

Mode of Transportation to the Hospital

In studies looking at factors influencing time to hospital arrival for symptoms of stroke, use of EMS consistently demonstrated a significant relationship with early

medical help-seeking. Though only about half of those suffering stroke utilize EMS (Mohammad, 2008). Mandelzweig et al. (2006) found that those who contacted and used EMS decreased their odds for delayed medical care seeking (aOR 0.26; 95% CI, 0.10, 0.63). Tong et al. (2012) found that EMS transport was a significant predictor of hospital arrival within 2 hours of symptom onset ($p < .001$). In addition, Gargano et al. (2011) found that those who used EMS had greater odds of early hospital arrival, under 2 hours, (OR 2.7, 95% CI, 2.0, 3.6). Also, Madsen et al. (2016) concluded, with use of EMS patients with symptoms of stroke were more likely to arrive to the hospital in under 3 hours (aOR 2.66, 95% CI, 2.08, 3.40).

Turan et al. (2005) found a similar magnitude of effect of the association between EMS use and early medical help-seeking within 2 hours of symptoms onset (OR 2.95). Conversely, they found that when adjusted for symptom severity in their study population, the benefit of early medical help-seeking and use of EMS arrival disappeared. Most likely this is since those with the most severe stroke symptoms were more likely to utilize EMS for hospital transport ($p < .001$; Eleonora et al., 2013). In addition to Turan and colleagues' finding, Kleindorfer et al. (2009) found that after adjusting for stroke severity use of EMS was dependent on the type of stroke symptoms experienced.

Another consideration in respect to mode of transportation to the hospital is social relationships. Social relationships are considered environmentally enabling factors, which may enhance or hinder timeliness to medical help-seeking (Andersen, 1995; Humphreys et al., 2014). There have been several studies demonstrating having another person present at the time of stroke symptom onset increased the odds of using EMS, thus leading to earlier hospital arrival than those who were alone at the time of stroke

symptom onset (Kim et al., 2011; Mainz et al., 2020; Mandelzweig et al., 2006; Mellon et al., 2016; Rosamond et al., 1998; Schroeder et al., 2000). Additionally, in a multivariable regression analysis Faiz et al. (2014) found that living with someone significantly increased the odds of seeking medical help in under 1 hour (OR 1.84, 95% CI, 1.0, 3.43) compared to those who lived alone. Also important, as mentioned earlier, is that there appears to be a difference in EMS utilization based on race/ethnicity; however, the results have not been consistently demonstrated. Finally, no studies were found demonstrating private transportation as superior to or significant with early medical help-seeking in stroke.

Need Factors

Need factors consist of two types of needs: *perceived need* and *evaluated need* (Andersen, 1995; Andersen & Newman, 2005). Perceived need is believed to be most closely associated with time to medical help-seeking and includes symptom severity and type of neurological symptoms experienced (Andersen, 1995; Andersen & Newman, 2005). Whereas, evaluated need requires cognizance of one's pre-existing conditions and the ability to relate current symptoms to past symptomatic events (Andersen, 1995; Andersen & Newman, 2005).

Need Factors: Perceived Need

Perceived need, the most influential dynamic of medical help-seeking, is a part of symptom experience and takes into consideration one's perceived symptoms and severity (Andersen & Newman, 2005; Humphreys et al., 2014). When a person perceives their symptoms as serious, they are more likely to engage in symptom management strategies equivalent to the level of perceived seriousness and severity of experienced symptoms

(Andersen, 1995; Humphreys et al., 2014). Additionally, if a person is incapable of realizing the seriousness of their symptoms, a family member, friend, or bystander may initiate medical help-seeking (Kim et al., 2011; Mandelzweig et al., 2006; Mellon et al., 2016; Rosamond et al., 1998; Schroeder et al., 2000).

Symptom Severity. As an element of symptom experience, symptom severity refers to the perceived level of somatic distress caused by an awareness of a physiological change within one's body (Humphreys et al., 2014). In general, the change is unpleasant and subjective, and may cause visible physical and/or cognitive limitations. Though symptoms are subjective, limitations caused by symptoms can be measured objectively.

The National Institute of Health Stroke Scale (NIHSS) is one of the most used scales for assessing the level of physical and cognitive impairment caused by ischemic stroke (Harrison et al., 2013). It is also commonly used in research studies on stroke. The NIHSS provides health practitioners with a quantifiable number for the purpose of conveying ischemic stroke severity (Brott et al., 1989). Additionally, symptom severity is linked to outcomes in ischemic stroke, e.g., the higher the NIHSS score, the greater the severity of stroke and the greater the likelihood of experiencing a poor outcome (Sablot et al., 2011).

The literature supports the premise that increased perception of symptom severity leads to greater and timelier utilization of medical services (Andersen & Newman, 2005; Eleonora et al., 2013; Faiz et al., 2014; Kim et al., 2011; Madsen et al., 2016; Mandelzweig et al., 2006; Rosamond et al., 1998; Rossnagel et al., 2004). Faiz et al. (2012) found that early arrival to the hospital was significantly associated with stroke severity ($p < .001$), use of EMS ($p < .001$), and younger age ($p = .048$). Likewise,

Eleonora et al. (2013) found that those who arrived at the hospital within 2 hours of stroke onset had higher NIHSS scores (mean 8.1, SD $\pm$ 8.9) than those arriving after 2 hours (mean 6.5, $\pm$8.4; p = .001). As well, Kim et al. (2011) found that stroke severity was a factor associated with early hospital arrival in under 3 hours from symptom onset, (aOR 1.96, 95% CI, 1.18, 3.27). While Madsen et al. (2016) found that those with mild symptoms of stroke were less likely to arrive to the hospital in under 3 hours from symptom onset (aOR 0.49, 95% CI, 0.34, 0.71) compared to those with more severe symptoms. However, if patients perceived their symptoms as being serious, regardless of objective severity, they had greater odds (OR 3.0, 95% CI, 1.2, 7.7) of hospital arrival within 3 hours (Rosamond et al., 1998). This premise was further supported by Mandelzweig et al. (2006) who found that if someone perceived their symptoms as severe, their odds of delaying treatment for stroke was low (OR 0.42, 95% CI, 0.1, 0.95). Whereas those who felt they had control of their symptoms were less likely to seek early care; thereby, having greater odds of delaying medical help-seeking (OR 2.45, CI 95%, 1.08, 5.71; Mandelzweig et al., 2006).

Similarly, studies found that milder symptoms led to longer delays in medical help-seeking (Madsen et al., 2016). As such, these findings further support the premise more severe symptoms lead to earlier medical help-seeking. Moreover, no studies contradicting the premise that more severe symptoms lead to earlier medical help-seeking were found.

Neurological Symptoms. There are typical symptoms of stroke taught to the general public. These symptoms include facial droop, arm weakness, and speech difficulties (American Stroke Association, 2021). While these symptoms are commonly

experienced in stroke, there are many other symptoms an individual may experience when suffering a stroke. Unfortunately, there are no symptoms specific to stroke, and some symptoms can be atypical such as isolated difficulty with swallowing manifested as choking when one drinks liquids or swallow's food. Additionally, symptoms of stroke may range from very mild such as slight numbness in one's arm, to severe such as paralysis of half one's body. As such, certain neurological symptoms appear to be more alarming to people than others; and thus, those symptoms may lead to earlier medical help-seeking (Beckett et al., 2015; Gargano et al., 2011; Madsen et al., 2016).

For instance, Madsen et al. (2016) examined predictors of early hospital arrival and found that those who suffered from weakness, numbness, speech, and vision difficulties tended to seek medical help earlier (p = .05) than those who suffered from headache, dizziness, nausea, or gait imbalance. The researchers also found that those with less severe symptoms were less likely to seek early medical help (aOR 0.49, CI 95%, 0.34, 0.71). Gargano et al. (2011) found that those who suffered from unilateral symptoms and speech difficulties were more likely to arrive to the hospital within 2 hours of symptom onset (aOR 1.5, 95% CI, 1.1, 1.9, aOR 1.6, 95% CI, 1.2, 2.2, respectively). Less likely to seek medical help within 2 hours of symptom onset were those who experienced balance and walking difficulties, visual deficits, confusion, loss of consciousness, and falls (Gargano et al., 2011). However, it is unknown whether those who delayed medical help-seeking were alone at the time of experiencing symptoms.

Further, Mochari-Greenberger et al. (2015) found that weakness/paresis, altered level of consciousness, and difficulty with speech increased the odds of utilizing EMS for transport to the hospital. The odds of utilizing EMS for these symptoms remained

statistically significant across gender; while; weakness/paresis and speech difficulty remained statistically significant across all race categories: White, Black, Hispanic, Asian, and other (Mochari-Greenberger et al., 2015). Similarly, Olascoaga Arrate et al. (2019) found weakness/hemiplegia, speech difficulties, and facial droop to be statistically significant factors associated with EMS utilization ($p < .001$). They further found that independently, limb weakness and hemiplegia increased the odds of EMS use (aOR 2.28, 95% CI, 1.51, 3.43) as did presence of a facial droop (aOR 1.97, 95% CI, 1.18, 3.30).

In a qualitative study, Beckett et al. (2015) surveyed 64 patients to explore facilitators and barriers to medical help-seeking. The researchers used a constructivist grounded theory approach. The main purpose of this approach is for developing theories or hypothesis, not for testing them (Charmaz, 2008; Creswell & Poth, 2018). As a result of their exploration, the researchers found several emerging themes. The first theme, *recognition of symptoms*, was relevant to the neurological symptoms experienced and with time of medical help-seeking. For instance, the researchers noted that those who experienced typical or what was considered classical symptoms of stroke, those with more severe symptoms, those who experienced a sudden onset of symptoms, and those who perceived their symptoms as serious, regardless of whether symptoms were associated with stroke or another condition, all led to earlier medical help-seeking (Beckett et al., 2015). Additionally, the researchers noted there was a range of symptoms related to delayed medical help-seeking. These included symptoms considered more mild or moderate, those symptoms not considered typical stroke symptoms such as a headache or other pain or nausea; those symptoms with more gradual or fluctuating onset, symptoms that were present when the person awoke, and symptoms that were attributed

to another condition (Beckett et al., 2015). This theme closely aligns with findings related to neurological symptom experience found in the quantitative literature.

Relative to neurological symptoms, there appears, aside from symptom severity, that some symptoms are more likely to provoke use of EMS than others. Therefore, leading to earlier medical help-seeking. Though no consistent, specific symptoms have been identified across all studies. As such, this study will specifically consider whether there is a difference in timeliness to medical help-seeking for those experiencing weakness or paresis, altered level of consciousness, speech disturbance, or other neurological symptoms.

Need Factors: Evaluated Need

When evaluating patients for specific diseases or disease related disorders, it is necessary for the health care practitioner to take into consideration a person's medical history and pre-existing conditions. For example, certain risk factors may put one at a high risk for stroke. As such the practitioner must maintain a high suspicion for serious conditions based on a person's previous medical history. Andersen et al. (1975) considers *evaluated need* a biological imperative and generally the domain of the health care professional (as cited in Andersen, 1995). However, for this study *evaluated need* takes into consideration the prospective of the individual experiencing symptoms. The measure of evaluated needs considers if a prior history of stroke or transient ischemic attack, or a prior history of other cardiovascular comorbid conditions affect time to medical care seeking for symptoms of stroke. While some may argue that evaluated need is a component of predisposing characteristics or perceived need, Andersen (1995) argues that it is the "evaluated component of need" (p. 3). Therefore, it is best explicated as an

evaluated need of an individual's determinants of health care utilization. As such, the assumption is individuals are aware of their own medical history and therefore able to consider the seriousness of their symptoms and decide when to seek medical care.

History of Stroke/Transient Ischemic Attack. It seems logical that if an individual has experienced a prior stroke or transient ischemic attack, suspicion for experiencing another similar event would be heightened. As such, the premise earlier medical help-seeking for reoccurring symptoms of stroke for those with a history of stroke or transient ischemic attack will be timelier than for those without a similar history may be made. However, this premise has not been supported by stroke literature.

Several researchers have analyzed the relationship among prior strokes or transient ischemic attacks and timeliness to medical help-seeking (Faiz et al., 2014; Kim et al., 2011; Schroeder et al., 2000; Turan et al., 2005). Most researchers found a non-statistically significant relationship between the two. For example, Faiz et al. (2014) found that for those who have a prior history of stroke, contacting EMS as the first point of contact was not statistically significant ($p = .41$). Schroeder et al. (2000) also found no statistically significant difference in use of EMS between those with a prior history of stroke and those without one ($p = .60$). While other studies have established a statistically significant association with calling EMS as first point of contact and early medical care-seeking (Madsen et al., 2016; Mandelzweig et al., 2006; Turan et al., 2005).

Additionally, Denti et al., (2016) found no statistically significant difference in those with a history of transient ischemic event and time to hospital arrival ($p = .53$). Whereas Kim et al. (2011) found a non-adjusted statistically significant difference in the odds of seeking care in under 3 hours for those with a prior history of stroke (OR 1.95,

95% CI, 1.25, 3.05) after adjusting for covariates having a history of a prior stroke did not significantly increase the odds of seeking early care (aOR 1.19, 95% CI, 0.68, 2.07). As well, using multivariate logistic regression analysis, Yanagida et al. (2014) looked at an aging urban population in Japan to see if there was a statistically significant difference in hospital arrival time for those experiencing symptoms of stroke who had a prior history of stroke versus those without a prior history of stroke. The researchers found there was no statistically significance difference in those seeking care within 4 hours of symptom onset who had a prior history of stroke and those who did not have a prior history of stroke (OR 0.76, 95% CI, 0.45, 1.27).

Alternatively, Beckett et al. (2015) found both facilitators and barriers to timely medical help-seeking was dependent on one's prior experience with stroke or transient ischemic attack. In their qualitative analysis, the researchers found a complex relationship between those with a history of transient ischemic attack or mild stroke and timeliness to medical help-seeking. The researchers found that both the severity and complexity of ones' prior experience influenced their timeliness to medical help-seeking—something that was not captured in the quantitative studies. As such, facilitators of early medical help-seeking included those individuals who experienced both severe symptoms of stroke and had a prior history of stroke. Whereas, barriers included experiencing symptoms that were different than a prior symptom experience, experiencing mild symptoms, or a prior experience with transient ischemic attack in which the symptoms fully cleared.

Cardiovascular Comorbid Conditions. In general, comorbidities refer to the presence of other chronic illnesses in addition to the one being studied. Comorbidities may have confounding effects on one's outcome or may be an independently associated

study variable. Moreover, stroke comorbidities may influence time to medical help-seeking. However, the relationship between cardiovascular comorbid (CVC) conditions, those most likely to be associated with stroke, and time to medical help-seeking have mixed results in the stroke literature (Faiz et al., 2012; Gargano et al., 2011; Madsen et al., 2016; Yanagida et al., 2014).

In regards to this study, CVC conditions refer to other cardiovascular events or morbidities, including atrial-fibrillation or atrial flutter (Afib/flutter); coronary artery disease or prior myocardial infarction (CAD/prior MI), carotid stenosis, diabetes mellitus (DM), dyslipidemia, heart failure (HF), and hypertension (HTN).

In a review of the stroke literature, only a small number of studies looked at how having a history of stroke affected time to hospital arrival, and an even smaller number of studies looked at how having CVC conditions affected hospital arrival times. In some studies, a couple CVC conditions were found to be statistically significant to earlier hospital arrival; though, this was not a consistent finding. For instance, Gargano et al. (2011) found a statistically significant relationship between early arrival, within 2 hours of symptom onset, and those with a history of CAD/prior MI ($p < .05$). Yet, the researchers did not find a statistically significant relationship with early arrival and a history of stroke or atrial fibrillation. Whereas Faiz et al. (2012) and Turan et al. (2005) did not find a statistically significant relationship with any CVC conditions and time to hospital arrival. Similarly, neither Madsen et al. (2016) or Yanagida et al. (2014) found a statistically significant difference in prehospital delay between those who had suffered a prior stroke and those who did not ($p = .56$).

However, Faiz et al. (2014) found increased odds of contacting EMS as the point of first medical contact in those with a history of dyslipidemia (aOR 1.89, 95% CI, 1.13, 3.16). Using EMS as the first point of medical contact decreased time from symptom onset to hospital arrival. Those who contacted EMS first had a median time of 51.7 minutes between symptom onset and hospital arrival compared to those who did not contact EMS (median time 73.9 minutes). The researchers, however, did not find any other significant relationships in those with HTN, prior CAD, prior stroke, or atrial fibrillation and using EMS as the point of first medical contact.

In a study conducted in South Korea (N=500), Kim et al. (2011) found a statistically significant relationship in stroke risk factors between early hospital arrivers (those arriving within 3 hours of symptom onset) and those who arrived later. For example, the researchers found having a prior history of stroke (p = .003), DM (p = .055), atrial fibrillation (p = .001), and CAD (p = .057) led to earlier hospital arrival compared to those who did not have these CVC conditions. Additionally, having HTN and dyslipidemia were not significantly related to hospital arrival times.

While Lacey et al. (2001) did not find a statistically significant relationship among hospital arrival times and a history of stroke/TIA or MI; the researchers did find a statistically significant relationship between arriving to the hospital within 3 hours from symptom onset and a history of atrial fibrillation (p = .002) and CHF (p = .001). Findings were similar for those arriving to the hospital within 6 hours compared to those arriving in >6 hours. Additionally, they found having two or more of CVC conditions were statistically significant to arriving to the hospital within 3 hours (p = .046) and within 6 hours (p = .009) when compared to those with no risk factors.

Use of Health Services

Time to Medical Help-Seeking

After the approval of intravenous alteplase as the first line treatment in acute ischemic stroke, time to medical help-seeking for symptoms of stroke had been a focus of numerous research studies (Mellon et al., 2016; Faiz et al., 2014; Tong et al., 2012). Time is especially important since alteplase is a time-dependent medication and must be administered within a certain period in order to be effective in treating stroke, as its effectiveness decreases as time to treatment increases (Kim et al., 2017; Saver et al., 2013). Although alteplase has been used for the treatment of stroke for over two decades, it continues to be underutilized due to delayed medical help-seeking (Fonarow et al., 2014; Hjelmblink et al., 2010; Moser et al., 2006; Reynolds & Ward, 2014; Schwamm et al., 2010).

While multiple studies have considered factors influencing time to medical help-seeking, no standardized time interval has been consistently used in the literature to delineate *early medical help-seeking* from *delayed medical help-seeking*. Some studies considering variables associated with timeliness of medical help-seeking have used a time interval of symptom onset to hospital arrival within 2 hours (Denti et al., 2016; Faiz et al., 2014;); time intervals of 3 hours (Madsen et al., 2016; Mandelzweig et al., 2006; Moloczij et al., 2008; Springer et al., 2017); time intervals of greater than 3 hours (Kim et al., 2011; Mellon et al., 2016; Reynolds & Ward, 2014); and time intervals of 6 hours or greater (Abilleira et al., 2011). Additionally, some studies used a combination of multiple intervals. For instance, Majersik et al. (2007) considered multiple time intervals from symptom onset to hospital arrival for their study. These categories included 0-3 hours,

>3-6 hours, >6-12 hours, >12-24 hours, and >24 hours. Though they looked at factors influencing time to medical help-seeking, their aims also included an attempt to understand arrival times for acute stroke patients and to understand what effect, if any, expanding the treatment window for stroke would have on treatment rates.

For this study, a time frame of 4 hours or less was considered early medical help-seeking and greater than 4 hours was considered late medical help-seeking. A 4-hour time interval from symptom onset to ED arrival still allows the medical practitioner time, e.g., 30 minutes, to fully assess the patient and patient's eligibility for treatment with alteplase, while encompassing the entire interval for acute ischemic stroke treatment with alteplase.

Summary

This chapter presented a review of the stroke literature relevant to this study's research variables and association with time to medical help-seeking. Additionally, this study's conceptual framework was described and the projected relationship between the independent variables and the dependent variable defined. Likewise, linkage among this study's conceptual framework, theoretical underpinning, and variables were provided.

To summarize, decision for and timeliness of health service utilization (time to medical help-seeking) are dependent on predisposing, enabling, and need factors. As such, age, gender, and race/ethnicity were the predisposing factors used for this study. The stroke literature did not demonstrate consistent findings about the effects that age, gender, and race/ethnicity may have on timeliness to medical help-seeking. A couple studies demonstrated a trend towards younger age and older age and earlier medical help-seeking compared to other age groups. However, since stroke most often occurs in older adults, those studies looking at subjects 55 years and younger tended to have a low

number of participants in their younger age groups. Whereas other studies finding a significant relationship with age and timeliness of medical help-seeking had very similar mean ages for the groups. In regards to gender, several studies showed a difference in time to medical help-seeking with females tending to take longer to arrive to the hospital after stroke symptom onset compared to males. Again, this was not consistent throughout the literature. Similarly, race/ethnicity demonstrated some difference in use of EMS for hospital arrival (thus, earlier arrival), but there are few studies supporting this conclusion. Thereby, making it premature to determine the significance race/ethnicity may have on timeliness to medical help-seeking for symptoms of stroke. Again, results were not consistently found across all studies involving race/ethnicity, and only a few studies looked at race as a variable affecting time to medical help-seeking.

The second group of factors influencing health service utilization are enabling factors. This study used medical insurance and mode of transportation to the hospital as enabling factors influencing time to medical help-seeking. Within the stroke literature, whether one had medical insurance or not did not appear to influence time to medical help-seeking. Some studies demonstrated the type of medical insurance a person has; specifically, income-based, government sponsored programs, may influence use of medical services. Though this may be true for the use of preventive medical services, literature has not found this to be a factor influencing timeliness of medical help-seeking for stroke. Mode of transportation to the hospital has been demonstrated to impact timeliness to medical help-seeking in stroke, with most studies demonstrating earlier hospital arrival times for those who use EMS.

Need factors are the third group of factors considered to impact health service utilization. Need factors were divided into perceived needs and evaluated needs. Perceived needs are considered most critical to timeliness of medical help-seeking. Both symptom severity and type of symptoms were the perceived needs variables used for this study. Symptom severity has been shown to consistently affect the timeliness of medical help-seeking for symptoms of stroke. With those experiencing more severe symptoms seeking earlier medical help compared to those experiencing mild symptoms. Also, as explained, some studies have demonstrated that certain symptoms are more significantly related to early help-seeking than others, but this too has not been consistently found in the stroke literature. For evaluated needs, having a prior history of stroke/TIA and or other CVC conditions were considered. Much of the literature did not support having had a prior stroke or TIA as influencing time to medical help-seeking, whereas some CVC conditions had been shown to be statistically significant to time of medical help-seeking. Once more, this has not been consistently established in the stroke literature. Lastly, no studies were found that had considered these independent variables and their association to timeliness of medical help-seeking in stroke in relation to a U.S.-Mexico border population.

Chapter III

Research Methodology

Study Purpose

The purpose of this study was to examine the relationship among selected variables including demographic characteristics, medical health insurance and type, medical history, symptom presentation, and mode of transportation to the hospital and their influence on medical help-seeking for symptoms of stroke. Further, the study sought to determine if certain variables were associated with the likelihood of delayed medical help-seeking for stroke. This chapter describes the study design, study purpose, sample population, and sample size. Additionally, variables of interest, study procedures, and analytical approach are detailed as well as ethical considerations.

Specific Aims

Aim 1

Assess the strength of association among demographic characteristics, medical health insurance and type, medical history, symptom presentation, and mode of transportation to the hospital for early medical help-seekers and late medical help-seekers.

Aim 2

Determine whether any select demographic characteristics, medical insurance status and type, medical history, symptom presentation, and mode of transportation to the hospital are associated with the likelihood of being a delayed medical help-seeker for symptoms of stroke.

Theoretical Underpinnings

For the purpose of this study, medical help-seeking, the dependent variable, was used as a surrogate for health care utilization. Health care utilization is the outcome or end process of Andersen and Newman's Framework for Viewing Health Services Utilization and at the center of the framework is individual determinants of health care utilization. Medical help-seeking is also a conceptual element of *symptom management strategies* within the symptom management theory (SMT; Humphreys et al., 2014). As such, the SMT and the HSU were utilized as the theoretical and conceptual foundations, respectively, for informing, interpreting, and understanding findings related to this study.

Study Design

This study was a retrospective cohort study of patients discharged with a diagnosis of ischemic stroke. The benefit of using a specific retrospective cohort, such as this, includes efficiency and cost effectiveness (Hulley et al., 2013). In a retrospective cohort study, the researchers have the advantage of utilizing pre-collected data from specific cohorts without the time and expense needed for conducting a prospective study. That is, provided the pre-collected data contain the needed information for the study's purpose.

Data collected for this study included documented time of stroke symptom onset and emergency department arrival time. Time to medical help-seeking was calculated from these two variables and then determined to be within or greater than 4 hours from symptom onset. For those cases without an explicit date and time of stroke symptom onset, emergency records were perused to determine if case arrival was within 4 hours or greater. Examples of cases without an explicit date and time of symptom onset but

determined to be within 4 hours included case records noting documentation such as, symptoms started 1 hour prior to arrival or (symptoms started) just prior to arrival. Whereas those cases determined to be greater than 4 hours included documentation such as, symptoms started day prior (to arrival) or symptom started almost 24 hours prior (to arrival). Early medical help-seekers were considered those cases arriving to the ED within 4 hours of stroke symptom onset and late medical help-seekers were considered those cases arriving to the ED greater than 4 hours after stroke symptom onset.

Study Setting

In the county of San Diego, there are 18 stroke receiving hospitals serving a population of approximately 3.3 million residents and an additional population of almost 153,000 people who cross the U.S.—Mexico border into the county of San Diego daily (County of San Diego Health and Human Services Agency [SDHHSA), 2014; Bureau of Transportation Statistics, U.S. Department of Transportation, 2019). As such, the county of San Diego's stroke receiving hospitals care for over 5,000 stroke victims on an annual basis (SDHHSA, 2014).

Case data for this study originated from patients who received care through one of four emergency departments with subsequent hospital admissions within a single health care organization located in Southern California. One hospital within the health care organization does not have an emergency department nor does it receive emergency medical vehicles, e.g., ambulances; therefore, data from that hospital were not included in the study.

The health care organization is in the county of San Diego and serves over 700,000 patients per year. It has five tertiary hospital facilities serving a large and diverse

population. Hospital campuses span from the Mexico border (with the most southern hospital located just eight miles north of the Tijuana, Mexico border) to 41 miles up the coastline of San Diego County.

Sample Cases

Inclusion Criteria

All cases over the age of 18 who received care through one of the health care organization's emergency departments for symptoms of stroke and were hospitalized and discharged with a diagnosis of ischemic stroke were included. Discharge from the hospital occurred between October 1, 2018 and December 31, 2019.

Exclusion Criteria

Cases admitted to a hospital from one of the health care organization's emergency departments without symptoms of stroke or admitted for something other than stroke or to rule out stroke. Any case admitted to the hospital without a discharge diagnosis of ischemic stroke, including hemorrhagic stroke, and cases experiencing a stroke after hospital admission.

Sample Size Power Calculation

Based on arrival incidences from published studies, 22% to 52% of patients arrive at the hospital within 4 hours of stroke symptom onset (Barber et al., 2001; Innocenti et al., 2014; Schwamm et al., 2013). So, choosing midway between published incidences, it was estimated that 37% of this study's population would be early medical help-seekers and we estimated a sample size of around 1000 qualifying cases. Using this sample size and assuming a two-tailed alpha of 0.05 and a power level of 0.80 this study will be able to detect an odds ratio for late medical help-seekers as small as 1.32.

Study Variables

Detailed descriptions of study variables are provided in the text below. The operational definitions and/or descriptions of study specific variables are based on the standardized, electronic *Case Record Tool* utilized for data abstraction from medical records into the GWTGs data repository. Thus, name of variables and operational definitions are consistent with those in the GWTGs abstraction tool. Abbreviated variables and their operational definitions are shown in Table 1.

Table 1

Variables and Operational Definitions

Name of Variables	Operational Definitions
Time to medical help-seeking	Time from initial symptom onset to time of ED arrival
Symptom severity	Presenting National Institute Health Stroke Scale (NIHSS) score
Neurological symptoms	Weakness/paresis; altered LOC; disturbances aphasia/language; other neurological symptoms; no neurological symptoms
History of stroke/TIA	Prior history of a stroke or TIA
CV comorbid conditions	Atrial fibrillation/flutter; CAD/prior MI; carotid stenosis; diabetes mellitus; dyslipidemia; heart failure; hypertension
Demographics	Age, race, and gender
Medical insurance	Does patient have medical insurance; type of coverage
Hospital arrival mode	EMS from home; private transportation/taxi/other from home/scene

Note. ED = emergency department. LOC = level of consciousness. TIA = transient ischemic attack. CAD = coronary artery disease. MI = myocardial infarction. EMS = emergency medical services.

Pre-Disposing Characteristics

Demographics

Age, race/ethnicity, and gender were abstracted from the participant's medical record and may have included self-report, i.e., reported birthday, information obtained from an identification card, or information provided by a third party at the time of hospitalization. Data were collected and recorded by trained hospital staff. The data are part of the GWTGs data registry. Age was collected and measured in number of years as continuous variable. Race and ethnicity were initially categorized as White, non-Hispanic; Hispanic; Black or African American, non-Hispanic; Asian, non-Hispanic; and other or unable to determine. However, based on a low number of cases in a few of the categories, it was determined that the data would be best classified by ethnicity as either Hispanic or non-Hispanic. Gender was measured categorically as either male or female.

Enabling Resources

Medical Health Insurance

Whether the participant had medical health insurance and what type of medical health insurance the participant had at the time of medical help-seeking for stroke was collected. Type of health insurance was further categorized as MediCal (Medicaid), Medicare, Medi/Medi (MediCal and Medicare), Private Insurance, None/UTD. Type of medical coverage served as a proxy for socioeconomic status (SES). Since medical records do not contain information specific to SES, other researchers have used medical coverage and type of coverage as a surrogate for SES (Ayanian et al., 1993; Foraker et al., 2010; Medford-Davis et al., 2016). Data were downloaded from GWTGs or abstracted from medical records.

Mode of Transportation to the Hospital

Transportation to the hospital's ED was determined by data previously abstracted from the medical records. The data included the following categories: EMS (Emergency medical services) from home/scene or private transportation/taxi/other from home/scene.

Perceived Need Factors

Neurological Symptoms

Neurological symptoms are based on initial medical evaluation at the time of emergency department arrival. Symptoms were categorized as following: weakness/paresis, altered level of consciousness, disturbance aphasia/language, other neurological signs/symptoms, no neurological signs/symptoms, and not determined.

Stroke Severity

Stroke severity was measured by the documented NIHSS score at the time of hospital arrival or the first documented NIHSS score. The NIHSS score is used to measure stroke symptom severity in ischemic stroke. It was developed for use in the initial acute stroke therapy trials for alteplase use in stroke and is the most widely used stroke severity scale for patients suffering from AIS (Brott et al., 1989). According to Brott et al. (1989), the scale demonstrates high interrater reliability, mean $k = .69$; and intraexaminer reliability, mean k for each examiner ranged between .77 to .66; correlation between different examiners from one test to the next was also strong $r_s = .98$ ($p < .001$); and correlation between seven-day NIHSS score and seven day computed tomographic scan lesion size was strong, $r_s = .74$ ($p < .001$), demonstrating strong validity of the scale to measure the severity of stroke. In general, the severity of a stroke is interpreted based on the NIHSS score as follows:

- NIHSS score of 0 equals no stroke
- NIHSS score of 1-4 equals minor stroke
- NIHSS score of 5-15 equals moderate stroke
- NIHSS score of 16-20 equals moderate/severe stroke
- NIHSS score of 21-42 equals severe stroke (Brott et al., 1989).

Evaluated Need Factors

History of Stroke or Transient Ischemic Attack (TIA)

History of previous stroke or TIA was collected from the GWTGs data registry and was also a part of the abstracted data from medical records. The data were categorized as either *yes*, if a case had a history of any type of stroke or TIA; or *no*, if there was no documented history of either condition.

Cardiovascular Comorbidities

Cardiovascular comorbidities were categorized by the number of total cardiovascular comorbidities documented in the medical records. For the purpose of this study cardio-vascular comorbidities specifically included a history of atrial fibrillation/flutter, coronary artery disease (CAD)/prior myocardial infarction (MI), carotid stenosis, dyslipidemia, and hypertension, and or diabetes mellitus. Data were abstracted from medical records.

Use of Health Services

Time to Medical Help-Seeking

Time to medical help-seeking was the dependent variable. For the purpose of this study, conceptually, time to medical help-seeking encompassed the temporal dimension of symptom experience and symptom management strategies until definitive medical

care, e.g., arrival to the ED, was reached. It is inclusive of the active and iterative processes of perception, evaluation, and response within the realm of symptom experience (Dodd et al., 2001; Humphreys et al., 2014). As such, time to medical help-seeking is very individualized and may lead to a temporally rapid or a prolonged course of action. Within the context of this study's conceptual model, time to medical help-seeking serves as a proxy for use of health services. This variable is operationally defined as the time interval from stroke symptom onset (if known) to the time of arrival to the emergency department, as documented in patients' medical records. For this study, time to medical help-seeking was dichotomized as either within 4 hours or greater than 4 hours.

Data Collection and Study Procedures

Data Acquisition

Stroke-related data for this study were obtained from the GWTGs data repository for all stroke cases discharged between October 1, 2018 and December 31, 2019. An individual patient data abstraction tool is used for initial data abstraction from medical records into GWTGs. The tool consists of a standardized, electronic *Case Record Tool s*pecific to stroke. The tool is integrated with electronic medical records to allow for information to be both prospectively and retrospectively collected (Ormseth et al., 2017). Additionally, health records were accessed by the study researcher for the purpose of verifying data and collecting missing data.

Data Quality

Accuracy and reliability of the user-submitted data entered in GWTGs have been previously evaluated (Xian et al., 2012). Except for three specific data elements, the

researchers found an abstraction accuracy rate, the agreement rate of abstracted variables between two or more abstractors, for the audited variables to be above 90%. Those exceptions included weight, serum creatinine, and venous thrombosis prophylaxis. None of the three problematic variables were used for the purpose of this study. However, a critical data element used for the purpose of this study to measure time to medical help-seeking, *date and time of last known well*, has been demonstrated to have an 85.3% accuracy rate. Interrater reliability for all audited variables demonstrated a kappa (k) for categorical variables as excellent agreement [$k \geq .75$] or intermediate to good agreement [$k = .40$ - $.75$]; with similar findings for intraclass correlation (*ICC)* of continuous variables. Additionally, there was an overall summary accuracy rate score of 96.1% for all variables.

Moreover, the health care organization providing data for this study has maintained one specific data abstractor assigned to the stroke program and it is her exclusive position to abstract data from the medical records of all patients discharged with a diagnosis of stroke or transient ischemic attack and upload it into GWTGs. The same individual has been in this position for over nine years and was the single abstractor during the time period determined for this study. The health care organization's stroke program also randomly selects three cases per quarter from each of its hospital sites for the purpose of assessing abstraction accuracy rates. Once the cases are randomly selected, the charts are abstracted by the stroke program coordinators from each respective hospital site and compared to the abstractor's abstraction results of those same charts. This has been an ongoing practice for over seven years and an overall accuracy rate of 90% or greater for all abstracted elements has been maintained.

Within the health care organization, all nurses who care for patients suffering from stroke are required to be certified in the performance of the NIHSS. After initial certification, nurses recertify every two years. Certification is completed using an online educational training program that uses training videos developed by the National Institute of Health. Training videos. After completion of the educational training videos, each learner is assessed for accuracy of their assessment skills by performing a series of six NIHSS assessments on actual, videotaped stroke patients. The learner's score for each patient is recorded and an overall score of 93% accuracy is required to receive certification (HealthCarePoint, 1999).

Protection of Human Subjects

This study comprised a secondary analysis of existing data. No human subjects were involved; therefore, case consents were not required. This type of secondary research for which a consent is not required yields a low risk for human subject harm. Prior to data collection, study proposal applications were submitted to both the health care organization's internal review board (IRB) and the University of San Diego's IRB. After initial application review by the IRBs, the study was considered exempt from full IRB committee review and approval was obtained from both the health care organization and university.

Downloaded and abstracted data were de-identified and recoded with an assigned case study number. A single, electronic copy of the linked medical record numbers and the participants' study numbers were kept separately from data in a password protected Excel file on the researcher's institutional personal hard drive, as well as the institutional shared drive specific to the stroke program, allowing for multiple layers of protection.

Medical record numbers were scrubbed from the full data file in order to maintain full anonymity.

Data Analysis

Data were transferred from an Excel spread sheet into IBM® SPSS® Statistics software (SPSS) version 26 for analysis. First, descriptive statistics were performed. These included percentages, measures of central tendency, range, and standard deviations. Descriptive statistics were performed for the overall study population as well as a comparison between early and late medical help-seekers. Continuous data were expressed as the mean and standard deviation of the mean. Categorical data were expressed as a percentage. Additionally, a comparison between included cases (n=1052) and excluded cases (n=46) was completed. This was done to ensure there were no statistical difference among the characteristics of those two groups.

Next, a bivariate analysis with 13 variables: Age, ethnicity, gender, presence of medical insurance, type of medical insurance, hospital transportation mode, weakness or paresis, altered level of consciousness, aphasia or language deficit, other neurological symptoms, NIHSS score, history of stroke or TIA, and number of cardiovascular comorbidities was performed. For the purpose of the bivariate analysis, age and NIHSS score were considered continuous variables and analyzed using a two-sample *t* test. Results were reported as mean and SD. Also, ethnicity was described as either Hispanic or non-Hispanic and analyzed using a chi-square test.

Lastly, the relationship among the independent variables and time to medical help-seeking, the outcome variable, was examined using a multivariate logistic regression analysis. Since most variables except ethnicity have been studied in relation to care

seeking time previously, hierarchical modelling for the logistic regression was used. Any variables with a p-value less than 0.05 were included in the model unless they highly correlated with another variable. Variables well delineated with consistent effects in the literature were entered first, then those with mixed effects from the literature, then variables with less certain information were entered last. Unadjusted and adjusted odds ratios with 95% confidence intervals were calculated. The Hosmer-Lemshow test was also calculated to assess goodness-of-fit for the variables in the model.

Summary

This chapter described study methodology. Study design, setting, and case inclusion and exclusion criteria were explained. Independent and dependent variables were defined and operationalized. Additionally, a description of procedures for the protection of human subjects was included. Lastly, data collection procedures, data quality, and data analysis were described as well as study limitations.

Chapter IV

Results

The primary objective of this study was to identify variables that were associated with the likelihood of delayed medical help-seeking for symptoms of stroke. Independent variables included demographic characteristics (age, gender, race/ethnicity), status of medical health insurance and type, medical history, symptom presentation and severity, and mode of transportation to the hospital. Results of the study were achieved by comparing cases of early medical help-seekers, those seeking help within four hours of symptom onset, with cases of late medical help-seekers, those seeking help in greater than four hours after symptom onset. Results include descriptive characteristics of study cases based on timeliness of help-seeking and the results of each research aim.

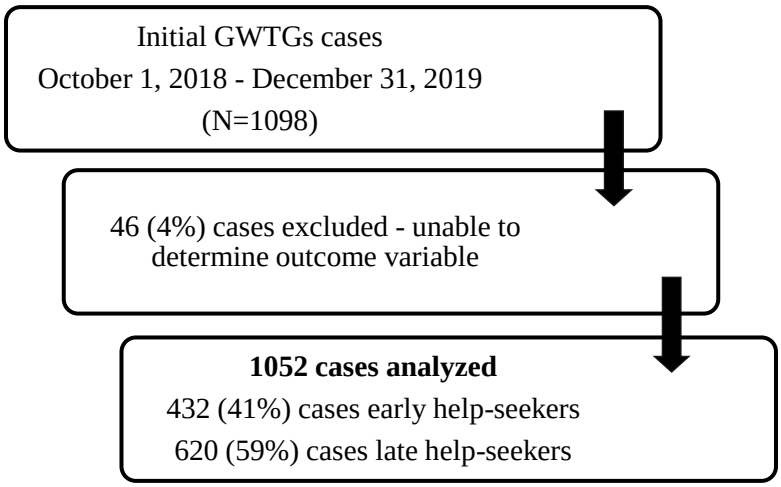
Data Collection Procedures

Initial data for this study were collected from the GWTGs data repository. Electronic medical records of each case were accessed to validate accuracy of data reported in the GWTGs and to collect missing variable data. Cases included all those who sought medical treatment for symptoms of stroke and were discharged with a diagnosis of stroke over a 14-month timeframe from October 1, 2018 to December 31, 2019. Initial medical care was sought through one of four emergency departments within a comprehensive health care organization geographically located within a U.S. Southern California-Mexico border region. All cases were subsequently admitted to one of four of the health care organization’s hospitals and included discharge from the hospital with a diagnosis of stroke.

A total of 1,098 cases were identified as having met inclusion criteria. However, 46 (4%) cases were excluded from analysis due to missing the outcome variable, time to medical help-seeking (further discussion below). Consequently, a final sample of 1,052 cases were included for the purpose of analysis (see Figure 3). This final sample was adequate to meet the specific aims of this study.

Figure 3

Case Selection



Excluded Cases

The excluded cases were compared to the retained cases in order to assess if any significant differences existed between the groups. No statistically significant differences existed between the groups except for mode of hospital transportation and altered level of consciousness (ALOC). A larger percentage of excluded cases arrived via EMS compared to retained cases (84.4% compared to 61.5%, $p = .001$), and a larger percentage of excluded cases had an ALOC compared to retained cases (54.3% versus 36.5%, *p*

= .014). It is reasonable to surmise that those with an altered level of consciousness would be more likely to need EMS compared to someone without an ALOC, and this may explain the difference in these variables between these two groups. Although the mean NIHSS score was higher in the excluded cases (9 ± 8.4) compared to the included cases (7 ± 8.1) the difference did not reach statistical significance (p = .121). Also, 23.9% of NIHSS scores for the excluded cases were missing, compared to 4.8% for the included cases. A possible explanation for the large percentage of missing NIHSS scores as well as a lack of a documented time of symptom onset may be that these cases were not initially thought to be presenting to the ED with stroke. Nevertheless, the large percentage of missing NIHSS scores in the excluded group limits the ability to draw any real conclusion about a difference in stroke severity between these two groups. A statistical comparison of the study's include and excluded cases are in Table 2.

Table 2

Comparison of Characteristics of Included Cases (n=1052) with Excluded Cases (n=46)

Characteristics	Included cases N = 1052	Excluded cases N = 46	*p*
	n (%)	n (%)	
Age	72.3 (14.2) [a]	69.0 (16.6) [a]	.122 [c]
Ethnicity			.372 [b]
Hispanic	259 (24.6)	14 (30.4)	
Non-Hispanic	793 (75.4)	32 (69.6)	
Gender			.469 [b]
Female	469 (44.6)	23 (50.0)	
Male	583 (55.4)	23 (50.0)	
Medical Insurance			.706 [d]
No	42 (4.0)	2 (4.3)	
Yes	1010 (96.0)	44 (95.7)	
Type of Insurance			.112 [d]
No Insurance/UTD	42 (4.0)	2 (4.3)	
Medicare only	554 (52.7)	16 (34.8)	

Characteristics	Included cases N = 1052	Excluded cases N = 46	*p*
	n (%)	n (%)	
Medicaid (Medi-Cal)	145 (13.8)	10 (21.7)	
Dual (Medicare/Medi-Cal)	183 (17.4)	12 (26.1)	
Private coverage	128 (12.2)	6 (13.0)	
Hospital Transportation			.001 [b]
Private/taxi/other	405 (38.5)	7 (15.2)	
EMS	647 (61.5)	39 (84.8)	
Weakness/paresis			.708 [b]
No	464 (44.1)	19 (41.3)	
Yes	588 (55.9)	27 (58.7)	
ALOC			.014 [b]
No	668 (63.5)	21 (45.7)	
Yes	384 (36.5)	25 (54.3)	
Aphasia/language			.393 [b]
No	414 (39.4)	21 (45.7)	
Yes	638 (60.6)	25 (54.3)	
Other neurological symptoms			.110 [b]
No	217 (20.6)	14 (30.4)	
Yes	835 (79.4)	32 (69.6)	
No neurological symptoms			.10 [d]
Yes	11 (1.0)	2 (4.3)	
No	1041 (99.0)	44 (95.7)	
NIHSS Score	6.9 (8.1) [a]	9.1 (8.4) [a]	.121 [c]
History of Stroke/ TIA			.711 [b]
No	727 (69.4)	31 (67.4)	
Yes	320 (30.6)	12 (26.1)	
Number CV Comorbidities	2.3 (1.4) [a]	2.2 (1.6) [a]	.646 [c]

Note. UTD = unable to determine. ALOC = altered level of consciousness. NIHSS= National Institute of Health Stroke Scale. TIA = Transient ischemic attack. CV = cardiovascular and include atrial fibrillation/flutter, coronary artery disease/prior myocardial infarction, carotid stenosis, dyslipidemia, hypertension, and/or diabetes mellitus. [a] Mean and standard deviation. [b] Chi-squared test. [c] Two-sample t test. [d] Fisher exact test.

Study Population Characteristics

A total of 1,052 cases with a discharge diagnosis of stroke between October 1, 2018 and December 31, 2019 were used for this study's analysis. Of these, 432 (41%) cases were early help-seekers, and 620 (59%) cases were late help-seekers.

The mean age of the study population was 72.3 $\pm$ 14.2 years (range 21-101), with slightly more males than females (55.4%). Three-quarters of study participants were non-Hispanic. Most of the population were White, non-Hispanic (57.1%). Ninety-six percent of the sample had some type of medical insurance coverage. The majority had Medicare (70.1%), and of these 17.4% (n=183) had dual Medicare-Medicaid (Medi-Cal) coverage. Using medical insurance as a proxy for SES, 31.2% of the study population were low income, insurance status could not be determined for 4.0%.

Most of the study population arrived at the emergency department by way of EMS (61.5%). Mean NIHSS score was 6.9 $\pm$ 8.1, with 53.8% (n=566) having NIHSS scores between 0 and 4, which would be considered a minor stroke. Most cases experienced some type of language deficit (60.6%), weakness or paralysis (55.9%), and/or other types of associated neurological symptoms (79.4%), e.g., facial droop, dizziness, acute visual loss, with one-third of the participants experiencing some degree of altered level of consciousness. For 11 people (1.0%), the type of neurological complaint(s) could not be determined. These cases were excluded from any category of neurological symptoms for the purpose of the regression analysis.

Further findings included a past medical history of prior stroke or TIA (30.6%). On average, the participants had a history of 2.3 $\pm$ 1.4 cardiovascular comorbidities, which included atrial-fibrillation or flutter, coronary artery disease or prior myocardial

infarction, dyslipidemia, hypertension, and or diabetes mellitus. Characteristics by arrival are presented in Table 3. Since NIHSS scores were highly skewed toward low scores, this variable was dichotomized to 4 or less, which contained about half the sample, and 5 or more.

Table 3

Case Characteristics by Arrival Time (N=1052)

Characteristics	Total n (%)	Arrival ≤ 4 hours (n = 432) n (%)	Arrival > 4 hours (n = 620) n (%)
Age	72.3 (14.2) [a]	73.0 (14.5) [a]	71.9 (14.0) [a]
Ethnicity			
Hispanic	259 (24.6)	91 (21.1)	168 (27.1)
Non-Hispanic	793 (75.4)	341 (78.9)	452 (72.9)
Gender			
Female	469 (44.6)	177 (41)	292 (47.1)
Male	583 (55.4)	255 (59)	328 (52.9)
Medical Insurance			
No	42 (4.0)	18 (4.2)	24 (3.9)
Yes	1010 (96)	414 (95.8)	596 (96.1)
Type of Insurance			
No Insurance/UTD	42 (4.0)	18 (4.2)	24 (3.9)
Medicare only	554 (52.7)	241 (55.8)	313 (50.5)
Medicaid (Medi-Cal)	145 (13.8)	47 (10.9)	98 (15.8)
Dual (Medicare/Medi-Cal)	183 (17.4)	73 (16.9)	110 (17.7)
Private coverage	128 (12.2)	53 (12.3)	75 (12.1)
Hospital Transportation			
Private/taxi/other	405 (38.5)	104 (24.1)	301 (48.5)
EMS	647 (61.5)	328 (75.9)	319 (51.5)
Weakness/paresis			
No	464 (44.1)	168 (38.9)	295 (47.6)
Yes	588 (55.9)	264 (61.1)	325 (52.4)
ALOC			
No	668 (63.5)	264 (61.1)	404 (65.2)
Yes	384 (36.5)	168 (38.9)	216 (34.8)
Aphasia/language			
No	414 (39.4)	142 (32.9)	272 (43.9)
Yes	638 (60.6)	290 (67.1)	348 (56.1)

Characteristics	Total n (%)	Arrival ≤ 4 hours (n = 432) n (%)	Arrival > 4 hours (n = 620) n (%)
Other neurological symptoms			
No	217 (20.6)	94 (21.8)	123 (19.8)
Yes	835 (79.4)	338 (78.2)	497 (80.2)
No neurological symptoms			
Yes	11 (1.0)	7 (1.6)	4 (0.6)
No	1041 (99.0)	425 (98.4)	616 (99.4)
NIHSS Score			
4 or less	566 (53.8)	212 (49.1)	354 (57.1)
5 or more	486 (46.2)	220 (50.9)	266 (42.9)
History of Stroke/ TIA			
No	727 (69.4)	275 (64.1)	452 (73.1)
Yes	320 (30.6)	154 (35.9)	166 (26.9)
Number of CV Comorbidities	2.3 (1.4) [a]	2.5 (1.5) [a]	2.2 (1.4) [a]

Note. UTD = unable to determine. ALOC = altered level of consciousness. NIHSS = National Institute of Health Stroke Scale. TIA = transient ischemic attack. CV = cardiovascular and include atrial fibrillation/flutter, coronary artery disease/prior myocardial infarction, carotid stenosis, dyslipidemia, hypertension, and/or diabetes mellitus. [a] Mean and standard deviation.

Associations with Time to Medical Help-Seeking

There was a significant difference between early medical help-seekers and late medical help-seekers for 8 of 13 variables (see Table 4). Significant variables included ethnicity ($p = .043$), gender ($p = .049$), mode of hospital transportation ($p < .001$), weakness/paresis ($p = .005$), language deficit ($p < .001$), NIHSS score ($p = .001$), history of stroke/TIA ($p = .002$), and number of comorbidities ($p < .001$). NIHSS scores were highly correlated with symptoms on which the scores were derived; therefore, symptoms were not included in the regression model. Also, comorbidities were highly associated with history of stroke/TIA and were not included in the regression model.

Table 4

Characteristics of the Study Participants by Early versus Late Arrival

Characteristics	Arrival ≤ 4 hours (n=432) n (%)	Arrival > 4 hours n= (620) n (%)	*p*
Age	73.0 (14.5) [b]	71.9 (14.0) [b]	.221[b]
Ethnicity			.043 [c]
Hispanic	91 (21)	168 (27.1)	
Non-Hispanic	341 (79)	452 (72.9)	
Gender			.049 [c]
Female	177 (41)	292 (47.1)	
Male	255 (59)	328 (52.9)	
Medical Insurance			.810 [c]
No	18 (4.2)	24 (3.9)	
Yes	414 (95.8)	596 (96.1)	
Type of Insurance			.198 [c]
No Insurance/UTD	18 (4.2)	24 (3.9)	
Medicare only	241 (55.8)	313 (50.5)	
Medicaid (Medi-Cal)	47 (10.9)	98 (15.8)	
Dual (Medicare/Medi-Cal)	73 (16.9)	110 (17.7)	
Private coverage	53 (12.3)	75 (12.1)	
Hospital Transportation			< .001 [c]
Private/taxi/other	104 (24.1)	301 (48.5)	
EMS	328 (75.9)	319 (51.5)	
Weakness/paresis			.005 [c]
No	168 (38.9)	295 (47.6)	
Yes	264 (61.1)	325 (52.4)	
ALOC			.179 [c]
No	264 (61.1)	404 (65.2)	
Yes	168 (38.9)	216 (34.8)	
Aphasia/language			< .001 [c]
No	142 (32.9)	272 (43.9)	
Yes	290 (67.1)	348 (56.1)	
Other neurological symptoms			.449 [c]
No	94 (21.8)	123 (19.8)	
Yes	338 (78.2)	497 (80.2)	
NIHSS Score [a]	7.9 (8.6) [b]	6.2 (7.6) [b]	.001[d]
History of Stroke/ TIA			.002[c]
No	275 (64.1)	452 (72.9)	
Yes	154 (35.9)	166 (26.8)	
Number of CV Comorbidities	2.5 (1.5) [b]	2.2 (1.4) [b]	< .001[d]

Note. UTD = unable to determine. ALOC= altered level of consciousness. NIHSS = National Institute of Health Stroke Scale. TIA = transient ischemic attack. CV = cardiovascular and include atrial fibrillation/flutter, coronary artery disease/prior myocardial infarction, carotid stenosis, dyslipidemia, hypertension, and/or diabetes mellitus. [a] early arrivers (n=420) and late arrivers (n=581). [b] Mean and standard deviation. [c] Chi-squared test. [d] Two-sample t test.

Regression Findings

Based on findings from the bivariate analysis and literature, variables were added into a hierarchical linear regression model. The first block included gender, mode of transportation for hospital arrival, and NIHSS score. History of stroke or TIA and ethnicity were added as a second block. Results of the hierarchical regression are found in Table 5, and included both unadjusted odds ratio and adjusted odds ratio. The adjusted odds ratio, reported as aOR, controls for covariates in the model. The Hosmer-Lemshow test, a goodness-of-fit statistic, was .368 indicating the model was a good fit for the data. The Nagelkerke R^2 was .103, indicating that much of what may be associated with late medical help-seeking were not included in the model.

Demographically, being female was associated with increased odds of late medical help-seeking by 46%, (aOR 1.46; 95% CI 1.12, 1.89). Whereas being Hispanic was associated with increased odds of late medical help-seeking by 28%; however, after adjusting for covariates, this finding was not statistically significant (aOR 1.24, CI 95%, 0.91, 1.68). Further, not having a history of prior stroke or TIA was associated with increased odds of late medical help-seeking by 50% (aOR 1.50; 95% CI 1.14, 1.98).

Interestingly, NIHSS score was not demonstrated to be statistically significant in predicting if someone was an early or a late medical help-seeker (aOR 0.97, CI 95%, 0.74, 1.28). The strongest variable associated with late medical help-seeking in this study was mode of transportation to the hospital. Those who arrived by car had 3 times increased odds of late medical help-seeking (aOR 3.05; 95% CI 2.28, 4.10).

Table 5

Unadjusted and Adjusted Odds Ratios for Factors related to Late Care Seeking

Characteristics	Unadjusted Odds Ratio [95% CI]	Adjusted Odds Ratio [95%CI]
Female gender	1.28 [1.00, 1.64]	1.45 [1.12, 1.89]
Arrival by car/non-EMS	2.98 [2.27, 3.90]	3.05 [2.27, 4.10]
NIHSS Score $\leq$ 4	0.98 [0.97, 0.99]	0.97 [0.74, 1.28]
No stroke/TIA history	1.52 [1.70, 2.00]	1.50 [1.14, 1.97]
Hispanic	1.28 [1.00, 1.64]	1.24 [0.91, 1.68]

EMS = emergency medical services; NIHSS = National Institute of Health Stroke Scale; TIA = transient ischemic attack; CI = Confidence Interval

Summary

This chapter presented the results of this dissertation study. The primary objectives of the study were to see what type of relationship, if any, existed between selected independent variables and medical help-seeking. Initial statistical analysis demonstrated a statistically significant relationship among 8 of 13 chosen study variables. Five of these variables were then included into a hierarchical logistic regression model

and regression findings presented. Controlling for covariates, being female, non-EMS hospital arrival, and no stroke/TIA history were factors associated with being a delayed medical help-seeker.

Chapter V

Discussion and Conclusion

The primary purpose of this study was to determine if a significant relationship existed among certain independent variables and timeliness of medical help-seeking for symptoms of stroke. The significance of early medical help-seeking in stroke has been established in the literature (Bluhmki et al., 2009; Kim et al., 2017; Lees et al., 2010; Saver et al., 2013). As, early medical help-seeking permits more timely treatment and treatment options for individuals suffering a stroke. This includes first-line treatment with intravenous alteplase (Kim et al., 2017; Saver et al., 2013). Treatment with alteplase has been demonstrated to improve functional outcomes, decrease morbidity and mortality, and reduce health related cost.

Prior studies have explored relationships between certain predictor variables and time to medical help-seeking for symptoms of stroke, but significant variables explaining most of the variance in delayed medical help-seeking remains uncertain and literature continues to demonstrate conflicting evidence (Madsen et al., 2016; Moser et al., 2006; Teuschl & Brainin, 2010; Springer et al., 2017; Zerwic et al., 2007). Additionally, a review of the literature revealed few studies conducted in the U.S. have examined factors related to delays in medical help-seeking for symptoms of stroke; and no studies have examined delays in medical help-seeking for symptoms of stroke in a population residing within a U.S.-Mexico border county. And, although geographical differences were initially considered in the design of this study, it was not part of the final analysis. This was due to the type of data collected, which was not conducive to a closer examination of

potential immigration status, language barriers, or other social factors that may have influenced the timeliness of medical help-seeking.

In this cross-sectional study of 1,052 persons admitted to a hospital system with a diagnosis of ischemic stroke, the average age was 72 years, 25% were Hispanic, and 59% were delayed medical help-seekers. Of the five factors associated with delayed medical care-seeking, arriving by private vehicle was most strongly associated with delayed medical help-seeking; followed by not having a prior history of stroke or TIA, being female, and being of Hispanic ethnicity.

Discussion of Findings

For the purpose of informing, interpreting, and understanding the findings of this study, the Revised Symptom Management Conceptual Model of Dodd et al. (2001), and an adaptation of the Individual Determinants of Health Services Utilization's domain of the Andersen and Newman's (2005) Framework for Viewing Health Services Utilization were used as the theoretical and conceptual framework, respectively.

Pre-Disposing Characteristics

This study's pre-disposing characteristics, biopsychosocial aspects of the individual that influence all spheres of symptom management, included age, gender, and ethnicity. The study population had a mean age of 72 $\pm$ 14.2 years, there was a larger number of males than females, and approximately 75% of participants were non-Hispanics. Age was not found to have a significant influence on time to medical help-seeking. Overall, this population was young compared to populations of other published studies. Though studies have demonstrated mixed results about age and timeliness of medical help-seeking, especially in the youngest and oldest populations, the lack of

influence age had on timeliness of medical time-seeking in this study is consistent with several other studies (Kim et al., 2011; Springer et al., 2017).

This study had a smaller population of women (45%) compared to men, which was interesting as the prevalence of stroke tends to be higher in women than in men (Barker-Collo et al., 2015). Though age-specific incidences are higher in males (Petrea et al., 2009). The relatively young age of this study's population may explain the greater proportion of males to females. For example, the prevalence of stroke in males between the ages of 60-79 years is 6.1%; whereas females in this same age group have a prevalence of 5.2% (Benjamin et al., 2019). Additionally, the incidences of stroke in men is greater than that of women for all age groups except those over the age of 85 years (Petrea et al., 2009). Nevertheless, women in this study had statistically significant greater odds of being a late medical help-seeker than the men. This is consistent with the literature. For instance, Haki et al. (2020) showed a statistically significant difference in time of hospital arrival for women experiencing a stroke, with 60% of women presenting after 4.5 hours from symptom onset and having greater delay times in hospital arrival compared to men. Delayed hospital arrival times for women have been attributed to older age and living alone at the time of stroke (Mainz et al., 2020). These interesting variables were not considered for this study but do warrant future investigation.

Prior research reveals an increased stroke burden related to race/ethnicity (Schwamm et al, 2010). Within this study's population, Hispanics had a 28% increase of late medical help-seeking compared to non-Hispanics. However, this finding was no longer statistically significant after adjusting for covariates, most likely mode of transport to the hospital. Previous studies have shown Hispanics were less likely to use EMS for

hospital arrival compared to other groups, possibly contributing to delays in medical help-seeking (Mochari-Greenberger et al., 2015; Smith et al., 2010; Springer et al., 2017). This was also true in this study where Hispanics had 65% increased odds of using a car instead of EMS (OR 1.24, 95% CI, 1.24, 2.18).

Enabling Factors

Enabling factors are the necessary resources one must have in order to utilize medical services. For this study, enabling factors included whether someone had medical insurance, type of medical insurance, and mode of transportation to the hospital. Remarkably, 96% of study participants had some form of documented medical insurance, while 4% did not. Though this percentage may seem remarkably high, there are a few things to consider.

In March 2010, the Affordable Care Act (ACA) was signed into legislation with key provisions going into effect January 2014 (National Conference of State Legislatures, 2011). An overarching purpose of the ACA was to expand health insurance coverage to all Americans. By January 2018, approximately 93% of Californians had some form of health care coverage, and much of that coverage was provided through Medi-Cal (Public Policy Institute of California, 2018). Anecdotally, if a person without insurance were to be admitted to a hospital, such as the comprehensive hospital system represented in this study, hospital personnel would make efforts to ensure medical insurance coverage was obtained. Also, for the purpose of data collection for this study, to fully identify whether those covered by insurance prior to hospital admission or were granted coverage after hospital admission proved difficult. However, the percentage of those with documented insurance coverage, is not much different than what was validated statewide during the

same timeframe. As such, whether having medical insurance coverage affects early versus late help-seeking may be a moot point, especially considering almost 100% of the study population had some form of medical insurance coverage. Accordingly, data analysis showed that neither having medical insurance nor the type of medical insurance coverage a person had were statistically significant in influencing whether one was an early or a late medical help-seeker.

Mode of hospital transportation for the intent of this study was the other enabling factor. The variable *mode of hospital transportation* was dichotomized to include use of EMS or some other form of transportation such as private vehicle, taxi, unicycle, or another form of transportation from home or scene to the hospital's ED. Use of another form of transportation instead of EMS had the strongest association with delayed hospital arrival in comparison with the other study variables even after accounting for severity of symptoms. These findings have been consistently expressed throughout most of the stroke literature. Interestingly, however, two separate studies found after adjusting for symptom severity, the benefit of arrival by EMS no longer existed or was related to the type of stroke symptoms experienced (Kleindorfer et al., 2009; Turan et al., 2005). Mainz et al. (2020) also found social factors, such as living alone, may contribute to how quickly one arrives to the ED. This is especially true if you consider those who may experience an altered level of consciousness and who may not be able to independently contact EMS. This specific issue is further considered in the next section looking at perceived needs.

An additional consideration regarding mode of hospital transportation is EMS response time and hospital distance from scene. No studies were found that factored in

EMS response time or hospital distance in the statistical analysis. There may be a significant difference in EMS responsiveness and hospital distance by geographic location and both may be important when taking into considering timeliness of medical help-seeking. Data looking at EMS response time and hospital distance from scene were neither collected nor considered for this study.

Need Factors: Perceived Need

Perceived needs are a vastly influential and dynamic component of factors related to individual determinants of health care utilization (Andersen & Newman, 2005). Perceived needs, for the purpose of this study, included symptom severity as measured by the NIHSS and type(s) of neurological symptom experienced, i.e., weakness/paresis, ALOC, aphasia/language, or other neurological symptoms.

One of the most surprising findings in this study was the relationship between symptom severity and timeliness of medical help-seeking. Unexpectedly, there was no relation between having a mild stroke (NIHSS score ≤ 4) and moderate to worse severity. It may be that the NIHSS scores were low with over half scoring 4 or less and another 20% scoring 5 – 10. Most of the literature addressing the topic of timeliness to medical help-seeking in stroke found symptom severity to be positively correlated with early medical arrival (Andersen & Newman, 2005; Eleonora et al., 2013; Faiz et al., 2014; Haki et al., 2020; Kim et al., 2011; Madsen et al., 2016; Mandelzweig et al., 2006; Rosamond et al., 1998; Rossnagel et al., 2004). Then again, this study's population overwhelmingly had a symptom severity associated with mild strokes. It is possible that public health messaging and better health care coverage are leading to improved control of risk factors, e.g., high blood pressure, irregular heart rhythms, and smoking. As such,

risk factor reduction may be resulting in milder stroke presentations. Still, study data were reexamined, and accuracy assured.

On further reflection, the importance put on perceived level of somatic distress can vary differently from that which is objectively measured. This may be a primary driving force in influencing timeliness of medical help-seeking. Research conducted by Rosamond et al. (1998) reinforces this premise. Their research supports the proposition if one's symptoms are perceived as non-serious; for example, if you are not aware of a physiological change in your own body, i.e., due to an ALOC, you may not fully appreciate the need or be able to fully carry out the necessary procedures to contact EMS. In addition, research has indicated that if you believe you have control over your symptoms, the odds of delaying medical help-seeking increase over two times (Mandelzweig et al., 2006). The design of this study did not allow for the exploration of perceived seriousness of symptoms experienced. Though, most of the literature supports the premise that greater symptom severity leads to earlier medical help-seeking. Further exploration on this topic is warranted.

Additionally, research indicates experiencing certain neurological symptoms may lead to more immediate medical help-seeking in comparison to other symptoms (Madsen et al., 2016). For example, a sudden loss of vision may be very alarming, whereas, tingling in the arm may be easily explained away. Thereby, medical help-seeking may be influenced by the types of symptoms experienced. This study considered whether certain clinical symptoms including weakness/paresis, ALOC, aphasia/language, or other types of neurological symptoms influenced medical help-seeking. Weakness/paresis ($p = .007$) and aphasia/language ($p < .001$) were statistically significant with timeliness to medical

help-seeking. However, they were also highly correlated with NIHSS scores, and for this reason were not included in the regression model. A high correlation between neurological symptoms and NIHSS scores is expected as the NIHSS score is a summary score consisting of 11 items measuring stroke severity based on neurological symptoms.

Prior studies have supported the premise that certain symptoms including difficulty with language and weakness result in earlier medical help-seeking and higher utilization of EMS resources (Gargano et al., 2011; Madsen et al., 2016; Mochari-Greenberger et al., 2015). While NIHSS scores were demonstrated to be highly correlated with symptom data collected for this study and therefore excluded from the regression analysis, another limiting factor in relation to clinical symptoms was the way they were categorized. This study utilized the same categories as GWTGs: weakness/paresis, ALOC, aphasia/language, or another type of neurological symptom. Doing such, limited the collection of clinical symptoms to these specific categories. This too may have led to discrepancies between the literature and what was found in this study.

Need Factors: Evaluated Need

Evaluated needs included a history of stroke or TIA and the number of other prior cardiovascular comorbid conditions. For those who have a history of stroke or TIA, or who are knowledgeable of their stroke risks, a supposition was that they would be more inclined to evaluate a new onset of symptoms related to stroke with greater importance and urgency to seek medical help. Many quantitative studies did not find a statistically significant relationship between having a history of stroke or TIA and early medical help-seeking. However, a qualitative study done by Beckett et al. (2015) found a complex relationship existed between one's prior experience with stroke and help-seeking,

whereas the severity and complexity of the prior stroke subsequently influenced time to medical help-seeking. Additionally, there was limited research found that considered the effect other cardiovascular comorbidities had on time to medical help-seeking (Faiz et al., 2012; Turan et al., 2005). Consequently, this matter remains inconclusive.

In this study, a bivariate analysis demonstrated a statistically significant difference for both history of stroke or TIA and number of cardiovascular comorbidities. There was, however, a high correlation between history of stroke or TIA and number of cardiovascular comorbidities; therefore, number of cardiovascular comorbidities was not included in the regression model. Having a history or stroke or TIA remained a statistically significant factor in the regression model. That is, someone without a history of stroke or TIA had increased odds of delayed medical help-seeking compared with someone who had experienced a prior stroke or TIA. These results may add to current literature and reinforce the idea that prior experience influences timeliness of medical help-seeking. How strongly and in what direction having a prior history of stroke or TIA influences timeliness of medical help-seeking continues to need further exploration. Also, this study was unable to determine the influence of specific neurological symptoms on timeliness to medical help-seeking due to a high correlation with having a prior history of stroke or TIA. Therefore, this may be a good focus for further research.

Use of Health Services

Use of health care services, the outcome variable, was operationalized as the time interval from stroke symptom onset to arrival to the ED. This variable was labeled *time to medical help-seeking* and dichotomized as early medical help-seeking and delayed medical help-seeking. Based on findings from the bivariate analysis 5 factors were used

in the regression analysis. Using hierarchical modelling for the logistic regression, a model was found with a pseudo-R suggesting the included variables accounted for approximately 10% of the classification of outcome. This, however, leaves 90% of variance for medical help-seeking unexplained in this study.

Although literature has been inconclusive on what variables significantly influence medical help-seeking and no causal relationship has been established, several variables demonstrated statistical significance. Also, in the small number of qualitative studies looking at timeliness to care, certain themes have emerged such as seriousness of perceived symptom severity. Qualitative study findings relating to this topic may prove to have greater predictor ability on what influences timeliness to medical help-seeking in comparison to currently published quantitative studies. Quantitative variables can be limiting as a result of the study design. It is vital that future studies include more qualitative research designs and that quantitative studies are designed to further validate their findings.

Implications for Nursing Practice

Nurses understand the critical nature of timeliness of seeking medical treatment for symptoms of stroke. Many times, nurses are the initial point of contact for patients suffering stroke, whether by phone or in person. In the ED, nurses are responsible for initial contact, triaging, treatment, and disposition of stroke victims. Additionally, nurses care for people who suffer stroke across the continuum of care, including throughout hospitalization and post-discharge. Nurses are responsible for overseeing and implementing processes to rapidly and efficiently identify and treat victims of stroke. Additionally, nurses are responsible for educating the public on symptoms of stroke and

the necessity of timely medical care. Yet, despite on-going public education, which includes national campaigns from associations such as the American Heart Association/American Stroke Association, aimed to educate people on the symptoms and necessity of timely medical care for stroke, most patients still delay seeking medical assistance after experiencing symptoms of stroke. In this study, only 41% of patients arrived to the hospital in under 4 hours from stroke symptom onset. By identifying and understanding the variables influencing timeliness of medical help-seeking for stroke, nurses can better tailor education and create evidence-based interventions and strategies specific to improving timeliness to medical help-seeking.

In this study, a small but significant relationship among several variables associated with timeliness to medical help-seeking in stroke were identified. When educating patients and the public about stroke, it is beneficial for nurses to understand what variables influence the timeliness of medical help-seeking, and to ensure the influential factors are part of the education people receive. For instance, it has been demonstrated those who utilized EMS to reach medical care after experiencing symptoms of stroke tend to arrive to the hospital earlier than those arriving by some other form of transportation; therefore, it is important for nurses to educate people on the use of 911. It has also been demonstrated that people who have experienced a prior stroke or TIA and or have multiple cardiovascular risk factors are at a higher risk of stroke. Therefore, it is important that those at a higher risk understand this, know what symptoms to look for, and know what to do if they should experience symptoms of stroke.

Another important implication for nursing is in the realm of research. This study and prior studies have only been able to identify a small amount of variance in the

likelihood of early medical help-seeking in stroke. Nurse can design and implement further research that may be able to identify more significant variables or a greater amount of variance for explaining timeliness to medical help-seeking.

Limitation of Study

This research, however, is subject to several limitations, which will be addressed in this section. Limitations addressed in this section include limitations related to secondary data sources, population and sampling size, and inconsistencies with prior studies.

Electronic health records and a data repository were used as the sources of data for this study. Use of these data sources while efficient, limits the quantity and composition of available data; particularly, variables chosen for the purpose of this study were limited to those variables available in the data sources. Additionally, these sources utilize previously collected, secondary data. As a result, there was no way to confirm accuracy or legitimacy of the data contained within the data sources. Although the specific data repository used as the source data for this study has demonstrated high interrater reliability and high abstraction agreement rates, and data were confirmed through electronic health record review there was no guarantee on the true quality of the data; though, not more so than paper charting or other health record repository approaches.

Also, as a consequence of using restricted data sources, a limited number of quantitative variables associated with time to medical help-seeking could be considered. When in fact, time to medical help-seeking is a complex phenomenon involving multiple aspects of perceptual, behavioral, social, and cognitive processes (Leventhal, Phillips, &

Burns, 2016). Therefore, it is reasonable to speculate that additional variables exist that can better explain time to medical help-seeking in stroke, but were not considered for this study.

Additionally, the high percentage (96%) of persons with insurance coverage may be indicative of selection bias. As the low number of uninsured individuals did not provide for analysis of effects of possible immigration status on timeliness of medical help-seeking. Also, data used was from a population of patients seeking care within a single health care system. Based on these issues, it would be difficult to generalize this study's findings to other populations.

Further, a review of the collected race and ethnicity data demonstrated insufficient case numbers in certain categories. For the purpose of statistical analysis and study validity, data groups had to be collapsed and re-grouped based on non-Hispanic or Hispanic ethnicity; further limiting the ability to compare this study's results with prior published research and limiting generalizability of the study's results.

Prior research similarly addressing the topic of this study used various and multiple time intervals for considering early and late medical help-seeking. Though a 4-hour time interval was chosen for the purpose of this study, for reasons explained, no other studies considering a specific time interval of 4 hours could be found. Additionally, most prior studies were conducted in different countries with different medical systems of care. Consequently, comparison of the findings in this study with the findings of prior research is limited. Although, despite these limitations' new knowledge regarding the timeliness of medical help-seeking in stroke was gained, specifically information about this study's unique population.

Recommendations for Future Research

Like this study, most studies examining reasons for delayed medical help-seeking in stroke have been of a quantitative nature. These studies have also included retrospective designs and used previously collected, quantifiable data from secondary sources, such as health records. However, these studies too, have demonstrated little and inconsistent evidence for explaining why someone may be an early medical help-seeker or why someone may be a delayed medical help-seeker. As such, there appears to be limited usefulness of quantitative variables for considering influences to the timeliness of medical help-seeking in stroke. The decision on the timeliness of medical help-seeking for symptoms of stroke may depend more on an individual's situation including prior experiences, available resources, ability to understand and interpret the significance of symptoms, and the ability to make appropriate and cognitive decisions leading to the necessary next steps or actions (Dodd et al., 2001; Shaw et al., 2008). Conducting qualitative research for a construct such as medical help-seeking may lead to a better understanding of those variables influencing the timeliness of one's decision to seek medical help.

Though the theoretical underpinnings of this study, the SMT, considers some variables quantitative in nature, e.g., demographics, the overarching premise of the theory lends itself well to qualitative research designs. For example, under the realm of *Symptom Experience*, one must be able to initially perceive and evaluate one's symptoms in order to respond to those symptoms successfully and to initiate symptom management strategies. Furthermore, the process is an iterative process. Perception and evaluation are complex, multifactorial concepts that may not be fully captured using quantitative

measurements. The variables used for the purpose of this study included variables that could be quantified through use of tangible measurements. However, this study was only able to explain very little variance of the timeliness of medical help-seeking for stroke.

As such, it would behoove nursing researchers to design studies that are qualitative in nature and utilize the SMT as their study's theoretical underpinning. Researchers can also incorporate the larger framework of Andersen and Newman's Framework for Viewing Health Services Utilization. To predict possible relationships among certain, select variables and timeliness of medical help-seeking, this study utilized only a small part of the Andersen and Newman's framework, which focused specifically on individual determinants for health care utilization.

Conclusion

Suffering a stroke can lead to devastating long-term, severe disabilities or death. Timeliness of medical help-seeking for those suffering from stroke is critical for the initiation of first-line treatment, which may reduce morbidity and mortality and improved functional outcomes. Yet only a percentage of those who suffer stroke seek medical attention in time to receive first-line treatment. For those suffering an ischemic stroke, first-line treatment includes the administration of a thrombolytic to break up clots that have formed in the brain and to restore cerebral circulation. Treatment with a thrombolytic is time sensitive and must be initiated within 4.5 hours from stroke symptom onset in those who qualify for treatment. In the U.S., only about 12% of those suffering an ischemic stroke receive treatment with a thrombolytic (Zoler, 2019). And, while there may be several reasons why someone is not treated with a thrombolytic for ischemic stroke, the primary reason is delayed medical help-seeking (Messé et al., 2016).

For this dissertation study, data from a national stroke data repository and electronic health records were used to explore the relationship among certain independent variables and their influence on the timeliness of medical help-seeking for symptoms of stroke. This study presented results of a regression model that was able to explain 10% of the variance in delayed medical help-seeking for symptoms of stroke. Within this model, mode of transportation to the hospital, gender, and symptom severity as well as having a history of stroke or TIA, and ethnicity were all statistically significant variables explaining a small percentage of timeliness of medical help-seeking.

As discussed, the variables selected for this study were based on prior research and data repository availability. As such, the study design and available data allowed for a limited number of variables to be examined and to explain any substantial amount of variation in the dependent variable.

This study is unique in that it was conducted in a specific geographic area within the U.S. that shares a border with Mexico and has many people crossing the border into and out of the U.S. daily. This type of research had not been previously conducted in such a population. The design of the study limited exploration of other potential predictor variables such as immigration status and language barriers, which may better explain influences on timeliness to medical help-seeking. The design also limited the generalizability of findings to other populations. However, this research may inform future research considering influences on the timeliness of medical help-seeking in stroke or in other disease processes. Other study designs, such as those of a qualitative nature, may be used for future research to better understand those influences of timely medical help-seeking.

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APPENDIX A

USD IRB

Mar 4, 2020 9:18 AM PST
Jean Rockwell
Hahn School of Nursing & Health Science

Re: Exempt - Initial - IRB-2020-295, Time to Medical Help-Seeking For Adults Who Experience Symptoms of Stroke in a California-Mexico Border Region

Dear Jean Rockwell:

The Institutional Review Board has rendered the decision below for IRB-2020-295, Time to Medical Help-Seeking For Adults Who Experience Symptoms of Stroke in a California-Mexico Border Region.

Decision: Exempt

Selected Category: Category 4. Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met:

(i) The identifiable private information or identifiable biospecimens are publicly available;

(ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects;

(iii) The research involves only information collection and analysis involving the investigator's use of identifiable health information when that use is regulated under 45 CFR parts 160 and 164, subparts A and E, for the purposes of "health care operations" or "research" as those terms are defined at 45 CFR 164.501 or for "public health activities and purposes" as described under 45 CFR 164.512(b); or

(iv) The research is conducted by, or on behalf of, a Federal department or agency using government-generated or government-collected information obtained for nonresearch activities, if the research generates identifiable private information that is or will be maintained on information technology that is subject to and in compliance with section 208(b) of the E-Government Act of 2002, 44 U.S.C. 3501 note, if all of the identifiable private information collected, used, or generated as part of the activity will be maintained in systems of records subject to the Privacy Act of 1974, 5 U.S.C. 552a, and, if applicable, the information used in the research was collected subject to the Paperwork Reduction Act of 1995, 44 U.S.C. 3501 et seq.

Findings: None

Research Notes:

Internal Notes:

Note: We send IRB correspondence regarding student research to the faculty advisor, who bears the ultimate responsibility for the conduct of the research. We request that the faculty advisor share this correspondence with the student researcher.

The next deadline for submitting project proposals to the Provost's Office for full review is N/A. You may submit a project proposal for expedited or exempt review at any time.

Sincerely,

Dr. Thomas R. Herrinton
Administrator, Institutional Review Board

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