2019

Predictive Relationship Between Socio-demographics, Medication, and Treatment Completion Among Persons Experiencing Homelessness Treated for Tuberculosis

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2019

Abstract

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by

Sophia Ajoku

MPH, Fort Valley State University, 2014

BSc, Rivers State University of Science and Technology, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

Approximately 80% of people who contract tuberculosis (TB) in the United States are first infected with untreated latent tuberculosis infection (LTBI). LTBI is an ongoing public health concern in people who experience homelessness. Because of the transient nature of this population, it is often difficult for them to adhere to and complete treatment for LTBI. In this quantitative, correlational of a cross-sectional study, secondary data was from a public health clinic in southern U.S. The theoretical framework used for the study was the social ecological framework. Multiple logistic regression was used to determine if a statistically significant predictive relationship existed between sociodemographic factors (i.e., age, gender, shelter type, substance abuse status); medication type (i.e., Directly Observed Therapy versus Self-Administered Therapy (DOT vs SAT); and treatment completion among persons experiencing homelessness treated for LTBI. Age and substance abuse status were found to be related to treatment completion at statistically significant levels ($p < .05$). A chi-square analysis showed no statistically significant difference in adherence to TB treatment by treatment type (i.e., DOT versus SAT; $p = .831$). Positive social change could stem from interventions and prevention that focuses on the demographic groups that were found to be related to treatment completion at statistically significant levels to provide support to these groups and increase LTBI treatment completion in people experiencing homelessness.

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Dedication

This dissertation is dedicated to my wonderful husband, Osmond Ajoku, who has held me up through this journey and never allowed me to lose sight. I thank you for your love, patience, encouragement, sense of humor, and for keeping a state of balance in our home. I would not have been able to complete all that I have without you. Thank you!

And to my beloved children, Lemachi, Adanna, Kodirichi, and Chikere. Thank you for your patience, even when I am unable to take you all out to your favorite places, you were constant reminders of why I was sacrificing so much of myself to complete these academic pursuits. I pray that my tireless hours of study inspire you to reach for your dreams no matter how far away they appear. Thank YOU!

To my sweet mother, Rose Onyewumbu, you are the prayer warrior I know that never gets tired of praying on my behalf. Thank you, mom, for believing in me and always reminding me to put God first.

Also, to my late Dad, Late Chief Engr, Martin Onyewumbu JP, daddy you have wanted to be at my graduation, but to God be thy Glory I made it! I am certain that you traveled alongside with me and I miss you dearly.

Acknowledgments

Dr. Shari Jorissen, my dissertation chair, is deserving of even more than my sincerest gratitude for mentoring me through this adventure. Her encouragement and support were infinite and her vast intellect innumerable. Without her constructive criticism and consistently informative, fast, detailed feedback, this dissertation research would have not been of such quality.

I am also forever indebted to the expertise, patience, and encouragement my committee member, Dr. Aaron Mendelsohn brought to the team. His wealth of experience with research methods made the challenges surmountable.

I was unsure what to expect of the URR process but was pleasantly surprised to find Dr. Mountasser Kadrie comments significant, thorough, and truly dissertation quality. I am grateful.

Lastly, I was fortunate to have supportive and inspiring leadership at the Fulton County Board of Health, Respiratory Clinic. Many played a role in helping me think through challenges, provided helpful thoughts on how to approach an issue, and listened intently as I attempted to condense this work into a concise, impactful presentation. Specifically, Dr. David Holland was an incredible mentor outside of my dissertation committee. His encouragement and willingness to set aside time to advice proved essential to my success.

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Chapter 1: Introduction to the Study

Introduction

Tuberculosis (TB) is caused by a microscopic organism, *Mycobacterium tuberculosis*, and is most ordinarily connected with the lungs (Leung, Lange, & Zhang, 2013). It can, however, be found in different parts of the body, causing long-haul sequelae (e.g., aviation route tightening, neural deficiencies, or death; Shah, & Reed, 2014). In 2015, more than 10 million TB-related deaths were recorded globally, with a death rate of 19 per 100,000 persons (World Health Organization (WHO, 2016a)). The vast majority of TB deaths are in developing countries with an estimated 2, million deaths annually (Shakak et al., 2013). It is estimated that 1 billion individuals worldwide will be infected in 2020 and that over 150 million of these individuals will develop active TB and 36 million will die from the disease (Lewinsohn et al., 2016; WHO, 2016a). TB has been a public health issue among people experiencing homelessness (PEH) in the United States and internationally (Barmrah et al., 2013; Powell et al., 2017). Chapter 1 includes the following sections: the background of the study, problem statement, purpose of the study, nature of the study, research questions, hypothesis, definition of the term, theoretical framework, study assumptions, scope and delimitation, study limitations, and significance of the study.

Background

Active TB disease develops in 2% to 10% of persons infected with *Mycobacterium tuberculosis* (WHO, 2016a). Latent tuberculosis infection (LTBI) is noncommunicable and can be treated within nine months of starting treatment (CDC,

2019). However, if the treatment regimen is not completed, LTBI can remain and become an active and communicable version of TB (CDC, 2016).

In the United States, 1% of the population experiences homelessness in a given year, but more than 5% of the people with TB reported being homeless within the year before diagnosis (CDC, 2015). PEH have a high occurrence of conditions that are related to a higher risk for developing TB, including substance abuse, HIV infection, and living in crowded situations (CDC, 2016). PEH often lack access to medical care required to make an early diagnosis of TB (CDC, 2016; Yun et al., 2015). Several researchers have revealed that treating LTBI before reactivation and ensuring high rates of LTBI treatment completion would lead to effective prevention and control of the TB disease and, therefore, decrease the global morbidity and mortality rate (CDC, 2015; Nuzzo, Golub, Chaulk, & Shah, 2015; Powell et al., 2017). A progressive understanding of treatment completion for PEH diagnosed with LTBI as well as the variables related with treatment completion or noncompletion may help the TB control program to more suitably convey assets to enhance treatment completion rates and, in this way, enhance the population's well-being.

In this study, I examined the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., Directly Observed Therapy versus Self-Administered Therapy (DOT versus SAT)); and treatment completion among homeless persons who reside in homeless shelters in Fulton County, GA. Sufficient understanding of the predictors of LTBI treatment completion

among PEH is important for the formulation of appropriate public health policy interventions for the elimination of TB mortalities and morbidity.

Problem Statement

Several researchers have previously investigated the problem of TB in the United States (Andrew et al., 2010; Butler & Carr, 2013; Leung et al., 2013). Much of the TB burden is shouldered by a few large cities in the United States, and the homeless populations in those cities are disproportionately affected. TB patients in only 48 U.S. cities accounted for 36% of all U.S. TB patients, and the incidence rate (i.e., 12.1 per 100,000 residents) in these cities was higher than the national average of 3.2 per 100,000 residents (Collins et al., 2015). Nineteen cities had decreasing rates, but 29 cities, including some in Fulton County, Georgia (GA), have not seen this decrease (Georgia De partment of Public Health (GDPH, 2014)). Fulton County reported that being homeless has historically been a strong risk factor in developing TB disease (GDPH, 2014). An average of 29% of persons with TB in the county reported experiencing homelessness within the 12 months before their TB diagnosis (GDPH, 2014). With isoniazid (INH)-resistant TB being seen in homeless shelters, Fulton County's 2014 TB case rate was almost three times the national TB case rate, which constituted 88% of all reported cases of TB in the state and more than half of all cases in the country (GDPH, 2014). Therefore, the problem that I addressed in this research study was the LTBI treatment completion rate in those who are homeless in Fulton County, GA to address the ongoing health concerns for that population as well as the risk to the community due to this highly infectious disease.

Although the aforementioned research regarding TB in the homeless population has provided important findings, I have found no research that has examined the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness in this area. Interactions among contextual and individual risk factors create unique epidemiological risk factors and pathways for contracting TB by PEH in the United States, complicating the magnitude and severity of TB and public health efforts in the control and prevention of TB (see National Academies of Sciences, 2017).

Purpose of the Study

In this study, I examined the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness treated for LTBI as well as the difference in treatment completion between medication types used. Although research has been conducted regarding the risks associated with these variables and TB infection rates in the United States over the last 30 years (e.g., Azevedo et al., 2015; Bamrah et al., 2013; Dolla et al., 2017; Laurenti et al., 2012), few researchers have emphasized treatment completion among PEH in Fulton County, GA (Holland et al., 2019; Onwubiko et al., 2019; Powell et al., 2017). I am hoping that the results of my study can be used to inform the public health leaders in Fulton County regarding their programs to address TB in this population by focusing treatment efforts

based on sociodemographic factors and medication type in hopes of increasing LTBI treatment completion.

Research Questions and Hypotheses

The following research questions and corresponding hypotheses guided this study:

RQ1: What is the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection?

$H_0$1: There is no statistically significant predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (DOT versus SAT); and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection.

H_a1: There is a statistically significant predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection.

RQ2: What is the difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection?

$H_0$2: There is no statistically significant difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection.

H_a2: There is a statistically significant difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection.

Theoretical Framework for the Study

I utilized the social ecological model (SEM) as the theoretical framework in this study. The SEM was first introduced as a conceptual model for understanding human development by Bronfenbrenner (1977) in the 1970s and later formalized as a theory in the 1980s. The underlying hypothesis was outlined by settling circles that place the person in the inside encompassed by different frameworks that effect that person's conduct. The microsystem nearest to the individual contains the most grounded impacts and envelops the collaborations and connections of the prompt environment (Fuentes et al 2019). The second circle is the mesosystem that looks past quick cooperation and incorporates those the individual has direct contact with (e.g., work, school, church, and neighborhood; Kilanowski, 2017). The ecosystem does not straightforwardly affect the individual but rather applies both negative and positive intuitive powers on the individual (e.g., network settings and informal communities; (Fuentes et al 2019)). The macrosystem incorporates societal, religious, and social qualities and impact (Evans et al 2014). Lastly, the chronosystem contains both inner and outside components of time and historical content (Bronfenbrenner, 1986).

The SEM focuses on the major contributors that might affect health (Sallis, Owen, & Fisher, 2008). The ecological perspective takes into account the influence of environmental factors at multiple levels, such as family, organization, community, and society, that shape individuals' behaviors and their susceptibility to disease (Evans et al 2014). Human beings, like other living organisms, are influenced by their ecosystems, and ecosystems exert their influence on individuals ranging from intrapersonal, interpersonal, institutional, and community levels (Ferguson et al. 2013).

The SEM has been applied in public health promotion, violence prevention, healthy college campuses, geriatric preventive health, and colorectal cancer prevention (Polit & Beck 2012). Lee et al. (2017) used the SEM to explain agricultural safety and health interventions, while Fletcher et al. (2017) used the SEM to describe the multiple communities and societal forces that impact mental health prevention, promotion, and intervention. The use of the SEM in this study permitted an understanding of the multilevel social and biophysical factors that predict the prevalence of TB and nonadherence to treatment completion among individual in the population under study (see Bronfenbrenner, 1994). While researchers conducting epidemiological examinations have concentrated on intrapersonal-level well-being hazard factors in the past, the future necessitates a far-reaching way to deal with epidemiological information describing the numerous elements that impact TB among PEH in Fulton County, GA. Noteworthy and dynamic interrelationships exist among the various dimensions of well-being that impact the incidence of TB, so general well-being mediations are destined to be progressively viable when they address these impacts in all dimensions simultaneously.

Nature of the Study

In this quantitative, correlational, cross-sectional study, I used secondary data from a public health clinic in Fulton County. This research design was appropriate because this type of research design is generally quick and easy to conduct, has fewer ethical issues, and is generally inexpensive (see Levin, 2006). I employed multiple logistic regression to address Research Question 1 and determine if there is a statistically significant predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness treated for LTBI. I used a chi-square analysis to address Research Question 2 and determine if there is a statistically significant difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness treated for LTBI. The independent variables were age, gender, shelter type, substance abuse status, and medication type (i.e., DOT versus SAT). The dependent variable was the completion of LTBI treatment.

I employed a purposeful convenience sample. This was appropriate because it was one of the most cost- and time-effective sampling methods available. This type of sampling technique can be useful in exploring anthropological situations where the discovery of meaning can be benefit from an intuitive approach (Lewis, Saunders, & Thornhill, 2012). The inclusion criteria included PEH who were screened for TB infection (using the QuantiFERON Gold-in-Tube test or tuberculin skin test [TST]) and treated for LTBI between January 2014 and December 2016 in Fulton County, GA.

Specific information about how the agency collects the data, how the data were provided for this study, and the inclusion and exclusion criteria can be found in Chapter 3.

Definitions

The following are definitions of terms used in this study:

Adherence: The process or condition to which a patient continues an agreed upon mode of treatment (Hugtenburg et al., 2013).

Directly observed therapy (DOT): A treatment strategy endorsed by the WHO whereby a health official watches/supervises the patient ingest their medication (Karumbi & Garner, 2015).

Homeless shelter: A service agency that provides temporary residence for individuals and families who are experiencing homelessness (National Healthcare for Homeless Council (NHHC, 2017)).

Latent tuberculosis infection (LTBI): A condition in which the TB germs live in the body and are viable for multiple years. Persons with LTBI are asymptomatic (i.e., they have no symptoms of TB disease) and are not infectious to others (CDC, 2017a).

Medication type: The TB medication treatment regimen a patient was placed on during diagnosis (i.e., DOT or SAT; FCBOH, 2016).

People experiencing homelessness (PEH): An individual without current permanent housing who may live on the streets, stay in a shelter, mission, single room occupancy facility, abandoned building or vehicle, or in any other unstable or nonpermanent situation (NHCH, 2017).

Self-administered therapy (SAT): A treatment strategy that requires no health official to watch/supervise the patient ingests their medication (Karumbi & Garner, 2015).

Substance abuse: An excessive, inappropriate, or illegal use of a substance, such as a drug, alcohol, or another chemical, that may result in addiction (Evans et al., 2005).

Tuberculosis (TB): A contagious, airborne, infectious disease that attacks the lungs, brain, spine, and kidneys (CDC, 2016).

Treatment completion: Documented completion of ≥ 80% of prescribed LTBI treatment that results in cure of the disease (CDC, 2018a).

Assumptions

I assumed the medical record data in the secured database represents only data from those PEH who were screened for TB infection (by either QuantiFERON Gold- in-Tube test or a TST by healthcare officials within Fulton County homeless shelters. Therefore, the results are only generalizable to PEH with LTBI in Fulton County and other similar jurisdictions in the United States. I also assumed that the interpretation of the TST was accurate on all PEH seeking treatment in a homeless shelter. Another assumption was that individuals diagnosed would come back for their TB test results so that they could be prescribed their medication regimen. Lastly, I assumed that the recommendation to initiate LTBI treatment was consistent among the study participants.

Scope and Delimitations

In this quantitative study, I examined the predictive relationship between sociodemographic factors, medication type, and treatment completion among homeless

persons who reside in homeless shelters in Fulton County, GA. This specific focus was based on the fact that previous researchers have shown a high prevalence of TB among PEH (Alami et al., 2014; Fazel, Geddes, & Kushel, 2014) and an association between the treatment and prevalence of TB (Yin et al., 2016). Qi et al. (2015) highlighted the need for preventive treatment as an essential effect on LTBI, finding that the implementation of the DOT short-course strategy can improve the cure rate of TB. McClintock et al. (2017) compared treatment completion for LTBI in patients treated with 9 months of INH, 3 months of INH and rifapentine, or 4 months of rifampin. They found out that 80% of patients were likely to complete 3 months of weekly INH and rifapentine as compared to 52% in the 9 months of group. Similarly, Lines, Hunter, and Bleything (2015) examined the impact of treatment completion rate and the cost of Twelve-dose regimen of fewer than 12 months, the likelihood to ensure adherence to treatment by tuberculosis patients.

The inclusion criteria for this study included being a PEH living in a homeless shelter, aged 18 years old and older, who had a diagnosis of LTBI between January 2014 and December 2016, were assigned to either the DOT or SAT treatment protocol, and were taken 3 months after treatment assignment. Data from any person not meeting this criterion were not included.

Limitations

I anticipated potential intrinsic and extrinsic factors that could have been a potential threat to the internal and external validity of this study. Antecedent-consequent biases may occur in a correlational study when there is generally no evidence of a

temporal relationship between exposure and outcome (Solem, 2015). Therefore, causation cannot be determined through the use of a correlational study of a cross-sectional nature (Creswell, 2013).

Another limitation of this study design was that success of the treatment in relation to the dependent variable may be difficult to interpret (see Solem, 2015). For example, completion of at least 80% of prescribed doses of LTBI treatment is generally deemed successful completion of the mediation regimen (CDC, 2018d). However, healthcare provider discretion may be used to determine treatment completion, which may have potentially impacted this research by producing a variance in the discharge diagnoses. Internal validity is considered because it gauges how strong the research method is in the study.

Early TB infection diagnosis in PEH can be challenging because many have barriers to accessing healthcare, including lack of health insurance, difficulty paying for care, lack of transportation, and lack of information needed to access care (CDC, 2016b). PEH face many stressors in their lives, which contribute to low health literacy with TB health issues (e.g., medication, disease prevention, and treatment; Connors et al. 2017). The negative effects of illiteracy and lower knowledge of TB on the treatment process for PEH (Bagheri et al. 2017; Bisallah et al. 2018; Doosti et al. 2015; Getahun, 2015) may affect how PEH residing in shelters know the warning signs and symptoms of TB to seek appropriate healthcare (Bamrah et al. 2013).

Potential extrinsic factors may arise from the fact that participants eligible for inclusion in this study may not be eligible for another study due to the transient nature of

the PEH population. PEH who received treatment for LTBI during the study period may no longer be residing in Fulton County. This may lead to an underestimation in the study findings. I was not able to control some issues, such as false negative TB tests as well as willingness and availability for TB test and treatment among the study population. Limitations encountered during the course of the study will be addressed in Chapter 5 in terms of issues with the generalizability of the results as well as how these limitations could inform future research in this area.

Significance

The resulting data and conclusions of this study could have the potential to enable epidemiologists at the county, state, and federal levels to further develop interventions and prevention methods aimed at inhibiting the spread of TB and increasing treatment completion rates in Fulton County, GA. This includes the spread of the disease not only among PEH but also within the overall population at the state and national levels. Such results could inspire positive social change by decreasing TB infection rates, which has the potential to have a positive impact on the economy and people's health in general.

Summary

As the general number of TB cases keeps on declining nationally, the disease remains a major public health threat in the United States (CDC, 2013b). TB cases among PEH have not decreased since 2009, representing 5.5 % of all cases in 2015 (CDC, 2016a). The case rate in PEH remains unsuitably high compared with individuals that are not homeless (Bamrah, 2010). Being infected with LTBI for many years can progress to incidence of the TB disease (CITE). Those who develop active TB disease are more

likely to require hospitalization and have the worst disease outcomes (Yuen, 2016). Several literature reviews have provided a detailed representation of the problem relating to TB diagnosis and treatment (Homels et al., 2017; Parriot et al., 2018). The purpose of this study was to examine the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion status among PEH. Chapter 2 contains information regarding the literature search strategy used, an in-depth discussion of the theory used in this study, and a thorough review of the literature related to this study.

Chapter 2: Literature Review

Introduction

TB has reemerged as a major public health concern globally and in the United States (Borgdorff, & Soolingen, 2013). In 2009, there were an estimated 9.4 million incident cases (between 8.9 million to 9.9 million) of TB globally (equivalent to 137 cases per 100,000 persons; WHO, 2010). The absolute number of cases continues to increase slightly from year to year, as slow reductions in incidence rates per capita continue to be outweighed by increases in population (Glaziou et al. 2015). A total of 9,093 new cases of TB were confirmed in the United States in 2017, and this represents an incidence rate of 2.8 cases per 100,000 (CDC, 2017a). The TB case count decreased by 1.8% from 2016 to 2017, and the rate declined by 2.5% over the same period (CDC, 2018a; Stewart et al. 2018). TB rates are ten times higher for PEH (Bamrah et al. 2010). Between 2010 and 2012, the CDC (2018a) indicated that over half of the individuals identified with TB did not have a place to call home. Previous researchers have shown that the majority of TB cases among PEH in the United States are attributed to reactivation of LTBI (Yuen, Kammerer, Marks, Navin, & France, 2016).

LTBI is caused by the bacteria, *Mycobacterium tuberculosis*, and even if LTBI does not involve active tuberculosis (i.e., contagious) and does not show any signs and symptoms of TB, LTBI can progress into an active TB disease if not properly treated (CDC, 2014a). It is estimated that 80% of all TB cases in the United States have an LTBI infection (Stewart et al. 2018). Homelessness increased the risk of TB disease in individuals with LTBI and was attributed to lack of health insurance and delay in seeking

treatment (United States Interagency Council on Homelessness (SICH, 2017). PEH are at high risk for TB because of crowded living circumstances (i.e., shelters), alcohol use, dysfunction of the immune system, substance abuse, HIV infection, and malnutrition (Feske, Teeter, Musser, & Graviss, 2013).

The purpose of this quantitative research study was to examine the predictive relationship between sociodemographic factors, including age, gender, shelter type, substance abuse status, medication therapy type (i.e., DOT versus SAT), and treatment completion among PEH in Fulton County, GA. In this chapter, I discuss the literature search strategy, theoretical framework, and literature review.

Literature Search Strategy

To locate literature for this review, I searched the following databases accessible through the Walden University Library: Academic Search Complete, ProQuest Central, Science Direct, CINAHL Plus, Medscape, ProQuest, Medline, and PsycINFO. Only peer-reviewed articles written in English that were published within the last 5 years were included in my search (i.e., 2013 through 2019; although, there were some studies published beyond 5 years ago that I reviewed because of their relevance to the history of the disease and research surrounding treatment. The following keywords were used in my search: *sociodemographic, sex, age, gender, race, ethnicity, socio-demographic, stigma, health literacy, drug resistance, disease barriers, HIV, TB treatment barriers, TB medication, treatment adherence, treatment status, seeking treatment, tuberculosis, homeless,* and *homelessness*. I obtained search results by first applying general terms (e.g., *latent tuberculosis infection [LTBI], treatment status, socio-demographic,* and

homeless) and later narrowing down the search by applying other key terms (e.g., *tuberculosis* and *homeless*). I received 705 results from ProQuest Health and Medical Collection, 64 from Academic Search Complete, 55 from Science Direct, 49 from CINAHL Plus, 55 from Science Direct, 436 from ProQuest Nursing and Allied Health Database, 53 from Medline with full text, 39 from PsycINFO, and 37 from ProQuest Central.

Theoretical Framework

The theoretical framework used in this study was the SEM. The SEM, also known as the ecological model, was developed and introduced to public health by Bronfenbrenner in the 1970s and was formalized as a theory a decade later (Tehrani et al., 2016). The SEM provides an understanding of ecological influence on human behavior (Tehrani et al., 2016). Bronfenbrenner postulated that to understand human development, the ecological system in which the individual was born, resides, and grows must be addressed (Glanz et al., 2002). Moos (1980) developed the social ecology of health-related models and specified five categories of the theory, including intrapersonal/individual factors (i.e., age, race, and gender); interpersonal/sociocultural factors (i.e., roles and social groups); and other broader institutional/community/environmental factors. Several years later, Stokols (1992) furthered the SEM of health promotion based on the premise that a person's health and well-being are influenced by multiple factors including personal attributes, such as genetic heritage, psychological tendencies, and behavioral habits, as well as the social

condition that they cooperate with (e.g., geography and climate, architecture, and innovation).

The SEM continues to be used in health promotion research and programming and suggests that behavior is influenced by interaction and interdependence among and between multiple levels, including intrapersonal/individual factors, interpersonal/sociocultural factors, and other broader institutional or environmental factors (Department of Health and Human Services, 2003). Sallis and Owen (1997) suggested that these factors influence behavior across these dimensions, that there are multiple levels of environmental factors that influence behavior, that environments directly impact behavior (i.e., unique characteristics of the ecological model), and that different environmental influences impact each health behavior in different ways (Institute of Medicine (IOM), 2011).

As the SEM is a methodological framework used by researchers to examine the dynamic relationships between individuals and their social environment (Sallis, Owen, & Fisher, 2008), it was employed as the theoretical framework of this study. The SEM provided me with a logical framework for the epidemiological study of the TB treatment status of PEH. The model permitted a unique opportunity to develop an understanding of the multilevel, individual, social, and biophysical factors that predict the prevalence of TB infection in homeless populations (see Joan et al., 2011).

The SEM demonstrates that behavior and health cannot be in isolation, and there is an interdependent network of relationships influenced by internal (i.e., individual) and external (i.e., environmental) factors that influence them (CDC, 2012a; Sallis & Owenas

cited in Blanz, Rimer, & Viswanath, 2008). The SEM has been widely applied in research in the framing of disease prevention and health promotion programs (Glanz et al., 2002; Li & Rukavina, 2012; Richard et al., 2004). The IOM (2003) recognized the SEM as the principal theoretical framework for designing public health programs for the promotion of healthy communities in the United States. One such program is the Healthy People 2020 (2013) program where health indicator targets are based on specific objectives that address the relationship between health status, biology, personal behavior, health sciences, social factors, and policies that emphasize an ecological approach to both individual and population level influences of health promotion interventions.

Supporting this model, the CDC (2013a) adopted the SEM as the main framework for its health promotion programs, which involve multiple bands of influence from individual, interpersonal, organizational, community, and policy levels for the prevention and control of colorectal cancer as well as violence prevention. Likewise, the WHO (2013a) employed SEM framework-based evidence to explain why some people or groups are at a higher risk of interpersonal violence, while others are more protected from it. This theory has also been used to visualize interpersonal violence as the outcome of interaction among many factors at the individual, relationship, and community levels as well as a result of societal values (WHO, 2013a). SEM has also been utilized in the investigation of social and contextual correlates (e.g., social norms, environment, social networks, and organizational support) influencing the adoption and maintenance of regular physical activity among minority and underserved populations in the United States (Fluery & Lee, 2017). The theory was used to study the diachronic interaction of

environmental factors contributing to health disparities among homeless populations (Edberg, Clear, & Vyas, 2011). Wilking et al., (2012) described the impact of different social factors on the risk of acquiring infectious diseases, with particular reference to rotavirus infections in Berlin, Germany, using of the SEM model. Li and Rukavina (2012) used the SEM model to study the most effective strategies for inclusion of overweight or obese students in physical activities at schools. Similarly, the theory was used by Ali and Naylor (2013) to explain the phenomena of intimate partner violence.

The ecological framework has also been used to identify and implement ecological tobacco control programs in health promotion programs in Canada (Richard et al., 2004). In the Food Stamp Program for low-income populations in the United States, the SEM has been used to provide a theory-based framework to characterize the nature and results of interventions conducted through larger public and private partnerships (Gregson, Foerster, Orr, & Jones, 2001; Kumpfer, 2014). The ecological model has also been used as the theoretical framework to guide the study of the interaction of individuals' awareness, preferences, skills, and social environment in the influence of behavioral practices implicated in the transmission and prevention of HIV (de Wit & Adam, 2012).

Related to this study, the SEM has also been used to depict the interactions of individual and contextual level factors in TB disease infection (CDC, 2012c). TB is a social disease caused by airborne pathogens that depends on human interaction within the community/household for its transmission (Ward et al., 2011). Some environments are more prone than others for transmission to occur, and these differences are partly

explained by community/house-level ecological influences that facilitate TB transmissions, such as poverty, overcrowding, lack of access to preventive healthcare, and other markers that have long been associated with increased prevalence of TB (WHO, 2016a). Due to its mode of transmission and the social and economic cost to society, TB is one of the diseases tracked closely by local, state, and federal health departments (Myer et al., 2006). Health departments also collect case-specific sociodemographic information, including age, gender, site of disease infection, country of origin, and drug resistance (Tim et al., 2014). This focus on individual sociodemographic data alone negates the ecological contexts of the disease occurrence. Information on community/household level and ecological risk factors for contracting TB are important for the formulation of appropriate TB prevention strategies (Millet et al., 2013).

The different levels of this theory include policy/enabling environment, organizational factors, community factors, interpersonal factors, and individual factors (see Figure 1). Each of the elements is described in more detail below.

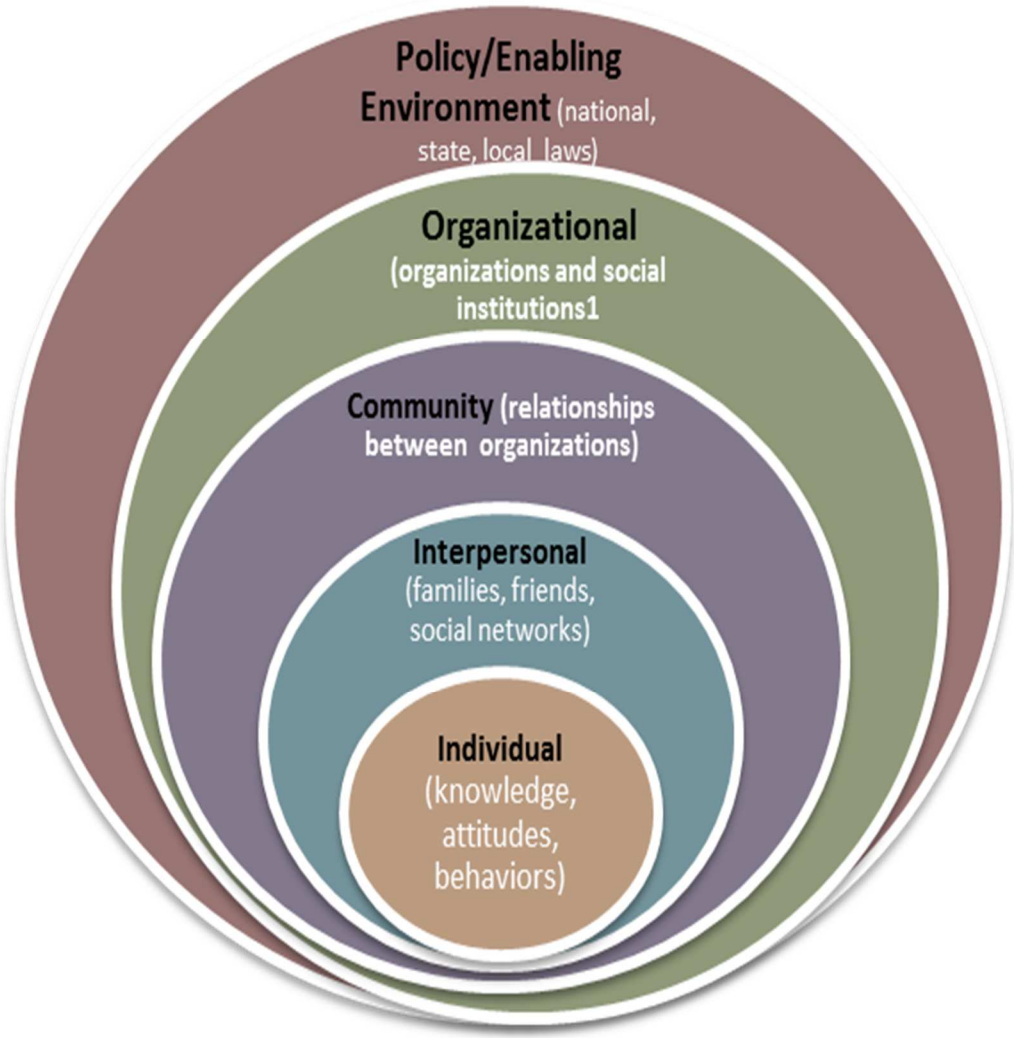

Figure 1. Socio ecological model: Individual and environmental factors. Adapted from "The Social Ecological Model: A Framework for Prevention," by the Centers for Disease Control and Prevention, 2018)https://www.cdc.gov/violenceprevention/overview/social-ecologicalmodel.html).

Policy Enabling Environment Factors

Public health efforts seek to encourage risk reduction by promoting individuals and community action as well as environmental factors through interventions designed to bring about situational or structural change as both polythetic (i.e., systematically removing the environmental obstacles to maximize disease prevention effect, such as

lobbying for changes in police practices; International Journal of Drug Policy (IJDP, 2018). Policy enabling environment factors also pertain to issues relating to government commitment to healthcare funding, health insurance coverage, and shelter policies that prevent the transmission of TB among homeless populations (CDC, 2016a). For example, most homeless shelters ensure that clients provide a valid TB status card indicating their TB status before admission to protect other residents from being exposed to those who are TB positive (GDPH, 2016). Some researchers have applied the SEM by approaching their investigations from multilevel perspectives encompassing intrapersonal, interpersonal, environmental, and community factors of influence (Mayne et al. 2015; Reis et al. 2016). The National Tuberculosis Surveillance System data (1993–2008) showed that age (i.e., an individual factor), homelessness (i.e., community or social relations), HIV coinfection (i.e., a healthcare system intervention), and substance abuse (i.e., a failure of health policy) were predictors of TB disease infection (WHO, 2013b). Previous researchers have cited the SEM as an appropriate conceptual framework for the prevention and control of both infectious and noncommunicable disease (David et al., 2014; Iwelunmor et al., 2016; WHO, 2013b).

Other researchers have established that TB comorbidity with HIV and diabetes presents unique challenges for TB prevention and control (Enrico et al., 2017; Knut et al., 2014). Dean and Fenton (2011) examined this phenomenon and determined that implementing an ecological approach that improves program collaboration and service integration; investing in economic interventions (e.g., microfinance). In the same position, they examined opportunities for aggressive policy and legislative initiatives that

change the context for disease prevention, shifting prevention programs to include a more diverse portfolio of prevention approaches that include individual, network, and community levels. A multilevel ecological approach was found to be the most effective framework for addressing cardiovascular disease risk factors among Hispanics on the U.S.-Mexico border by moving from a clinical care model to a community model of prevention through comprehensive community engagement (Balcaza et al., 2012).

Organizational Factors

Health system and organizations influences refer to multiple healthcare systems that PEH have to navigate to access healthcare services in Fulton County. Influences at this level involve provision, accessibility, and utilization of healthcare services, and enhancing collaboration with community-based organizations (COB) for the provision of integrated disease management services for PEH (Connors et al. 2017). Access to healthcare is crucial in disease prevention and control and refers to the degree to which individuals and the group can obtain appropriate healthcare from healthcare system promptly (Parriot et al. 2018; Mayberry et al., 2006). Lack of access to healthcare is one of the leading causes of poor health outcomes (Connors et al. 2017). Several researchers have documented healthcare access disparities among members of minority populations due to some reasons including inadequate or lack of health insurance and low individual income (Hernandez-Garduno 2002; Kemp 2005; Moonan, 2012; Rosenbaum, 2010). Structural barriers include organizational barriers to care and lack of transportation to and from health caregivers (IOM, 2009; Rae & Rees, 2015**).**

Community Factors

Community-level influences affect behaviors at small group levels including family and social networks (Bunnell et al., 2012). This includes the influences of family and social network on the individual relationship with local health services, social norms, and social stigma attached to TB and their influence on healthcare seeking behavior (Kranz et al., 2013). A well-known example of health behavior influence at this level is stigma and discrimination associated with TB among some cultures. Bara, Karki, and Newell (2007) found that TB is highly stigmatized in Nepal with considerable discrimination against sufferers by the public and healthcare workers. They also found perceptions that TB was a divine punishment among some members of the public. Stigmatization and discrimination diminish healthcare seeking behaviors and constitutes an impediment to TB prevention efforts (Giorgione, 2009). DiStefano, (2016) highlighted that the involvement of TB patients and communities in the design, planning, implementation, and evaluation of TB control initiatives is important to removing prejudices and discrimination, improving access to healthcare, and ensuring adherence to treatment regimens.

Interpersonal Factors

Interpersonal factors are also referred to at times as personal factors; these level influences focus on the relationship between a pair of individuals. Examples include patient-provider relationships and its impact on both the patient and provider as well as influences on family, significant other, or peer on the patient (Deena, 2016; McLeroy et al.,1988). The innate characteristics of age and sex may influence healthcare-seeking

behavior. Other interpersonal factors such as knowledge, attitudes, beliefs, and personality traits can also influence healthcare-seeking behaviors (Department of Health and Human Services, 2003). Men and women who are 51 years or older are more likely to have screening health checks than those who are 50 years or younger. Are women more likely than men to nominate? Preparedness to have annual health checks, willingness to seek advice from their healthcare providers and to attend health education sessions (Dereck et al.; Schulein et al., 2107). Sandra et al. (2015) found that African American patients characterized their visits with physicians less participatory than whites. Improving cross-cultural communication between patients and health providers affects patient involvement in health decision making, levels of satisfaction, and better healthcare outcomes (Vahdat et al., 2014).

Individual Factors

Individual-level influences include knowledge, attitudes, and perception, patient satisfaction, and social stigma that may influence health-seeking behaviors and adherence to treatment regimens (Da Silva, 2017). This level also addresses individual level issues that may affect health-providers behavior, such as adherence to guidelines, and standard recommendations for TB prevention and treatment (WHO, 2014). One of the most illustrative individual factors from the SEM perspective is DOT. This is the core element of tuberculosis care and control measure where the health providers watch and ensure that the patients ingest drugs as prescribed in TB and Multi-Drug Resistant (MDR) TB treatment and management through watching them place the drugs in their mouth and swallow them. DOT is related to reductions in primary TB drug resistance, acquired drug

resistance, and lapses in tuberculosis treatment (Karumbi & Garner, 2015). Noncompliance with DOT is associated with the increase in the occurrence of poor TB treatment outcomes and accounts for most treatment failures (Burma et al., 1997; Connors et al., 2017). DOT has also been linked to a reduction of drug resistance and provides treatment completion rates (Long, & Ellis, 2007; Stephanie et al., 2016). There are several risk factors for TB disease among PEH such as poverty, unemployment, homelessness, imprisonment, HIV infection, malnutrition, and lack of access to health care which is considered socioecological determinants of health (Eckel et al., 2013; Kong et al., 2002).

Literature Review Related to Key Variables and/or Concepts

In the following sections, I describe what TB is, the general symptom of TB, the discovery of TB, the condition of LTBI, and the risk factors for developing LTBI. I also present what previous researchers have found regarding the TB/LTBI treatment completion among PEH in the United States and barriers homeless population faces when placed on TB treatment.

Tuberculosis (TB)

On March 24, 1882, Dr. Robert Koch reported the disclosure of Mycobacterium tuberculosis, the bacterium that causes TB. Amid this time, TB killed 1 out of each 7 individuals living in the United States and Europe. Dr. Koch's revelation was the most vital advance taken toward the control and end of this dangerous infection (CDC, 2018c). Johann Schonlein coined the term "tuberculosis" in 1834, though it is estimated that

Mycobacterium tuberculosis may have been around for as long as 3million years (CDC, 2018c; Lawn & Zumla, 2011).

TB was called phthisis in ancient Greece, tabes in ancient Rome, and schachepheth in ancient Hebrew. In the 1700s TB was called the white plague due to the paleness of the patients. TB was commonly called consumption in the 1800s even after Schoenlein named it tuberculosis. During this time, TB was also called the "Captain of all these men of death (CDC, 2018c, p. 1). During the Middle Ages, TB of the neck and lymph nodes was called scrofula. Scrofula was believed to be a different disease from TB in the lungs (Michael & Arlen, 2017). The names for the type of TB tell where TB is located (pulmonary, extrapulmonary) and how to treat it (drug-susceptible, drug-resistant, multi-drug resistant, and extensively drug-resistant) (Dheda et al. 2016).

Types of TB

TB Disease. TB is an airborne disease that generally attacks the lungs. TB disease can cause demise if not treated (CDC, 2017a). M. Tuberculosis is conveyed in airborne particles considered droplet nuclei that can be created when people who have pulmonary or laryngeal TB disease hack, sniffle, yell, or sing (American Lung Association, 2018) The particles are approximately 1– 5 μm (micrometer); normal air flows can keep them airborne for delayed periods and spread them all through a room or building (Emory Healthcare, 2018). Tuberculosis is generally transmitted just through the air, not by surface contact. After the droplet nuclei are in the alveoli, the nearby contamination might be set up, trailed by dissemination to depleting lymphatics and hematogenous spread all through the body (Richard, 2014). Disease happens when a helpless individual

breathes in droplet core containing tuberculosis, and the droplet nuclei cross the mouth or nasal sections, upper respiratory tract, and bronchi to achieve the alveoli. People with TB pleural effusions might likewise have simultaneous unsuspected pulmonary or laryngeal TB disease. As a rule, inside 2– 12 weeks after beginning contamination with, the immune reaction limits extra multiplication of the tubercle bacilli, and immunologic test results for M. tuberculosis contamination become positive (Mark et al,. 2017) TB is spread most effectively in shut spaces over an extensive stretch. Individuals with debilitated immune systems (those with HIV/AIDS, those getting chemotherapy, or children under 5 years old, for example) are at more serious risk for developing TB disease (CDC, 2017a).

The general symptoms of TB disease include feeling sickness or weakness, loss of appetite, shortness of breath, persistent cough, chest pain, weight loss, fever, and loss of appetite (WebMD, 2016; CDC, 2017a).TB can affect other parts of your body, including your kidneys, spine or brain. When TB occurs outside the lungs, signs, and symptoms, vary according to the organs involved. For example, people suffering from tuberculosis of the spine may feel back pain while others suffering from tuberculosis in the kidneys might experience blood in the urine (CDC, 2017a).

Latent TB Infection (LTBI).

In this condition, the TB germs live in the body and are viable for multiple years. Persons with LTBI are asymptomatic (they have no symptoms of TB disease) and are not infectious to others (CDC, 2017a). If this TB germ in the body is not treated the TB germ become active, grow, and multiply into TB disease, a process called "TB reactivation."

The lifetime risk of reactivation for a person with documented LTBI is estimated to be five- ten %, with the majority developing TB disease within the first five years after initial infection (WHO, 2016a).

However, the contributing factors for developing LTBI include HIV infection, organ transplant, or other immunosuppressive medications, the foreign-born person from a high TB prevalence country, and has prolonged stay or worked in an urban homeless shelter and has no access to medical care. These factors promote the growth of the germ, and the infected person may develop a fully active TB infection (CDC, 2016b). Many people with LTBI never develop TB disease; some develop TB disease soon after becoming infected (within weeks;Thomas, 2017). It is not easy to become infected with tuberculosis. Usually, a person has to be close to someone with TB disease for a long period (American Lung Association, 2018).

The most commonly used diagnostic tool for tuberculosis is a simple skin test (TST). A century-old test with known limitations (Madhukar et al., 2014) Due to the limitations of this test, particularly in areas affected by the HIV epidemic and its associated high mortality among smear-negative cases, there is a widely felt need for a more rapid, accurate and convenient test (CDC, 2016b; Perkins, 2006). A small amount of a substance called Purified Protein Derivative tuberculin is injected below the skin of the forearm. Within 48 to 72 hours the result was made visible depending on the red welt (induration) formed around the injected site. If an induration occurs within 72 hours, that means there is evidence of the presence of TB infection (CDC, 2016b). Mostly, the size of the induration determines whether the test results are significant. The biggest advance

in recent years has been the development of in Virto T- cell-based interferon- y release assays (IGRAs) that use antigens more specific to M. tuberculosis than the purified protein derivative used in the TST (CDC, 2016b) Different capacity benefits of IGRAs consist of logistical convenience, avoidance of poorly reproducible measurements inclusive of skin induration (Pai et al. 2014). Basic, because of its high specificity IGRAs may be useful in low–endemic, excessive-income settings wherein go-reactivity due to Bacilli Calmette Guerin (BCG) would possibly adversely affect the software of TST (Sollai et al. 2014).

TB Prevalence

Global Prevalence. One third of the world's population is infected with TB bacterium, and 16.2 million people currently have TB disease (CDC, 2013a; NIH, 2016). Annually 9.6 million people become ill with TB, and 1.5 million people die from the disease worldwide (NIH, 2016).

Even though TB is treatable, the financial/economic impact of TB can be substantial for people, families, communities, and governments. Family unit main supporters with TB are frequently unable to work for a considerable length of time (WHO, 2018a). As indicated by the WHO (2018a), TB costs the world over $21 billion every year, including $9.2 billion for treatment and control exercises and $12 billion in extra monetary expenses and lost profitability. The economic cost of TB to the United States was approximately $37.2 billion in 2009 which included $20.9 billion in direct health care cost, $7.4 billion in indirect morbidity cost, and $8.9 billion in direct health care cost (CDC, 2013b) Treating a solitary case of XDR-TB could cost more than

$694,000 enough to clear off a small cities aggregate public health budget for a year. TB remains one of the main sources of death and disease in the world every year (CDC, 2013c).

Incidence in the United States. A total of 9,093 new cases of TB were reported in 2017 the United States which represented an incidence rate of 2.8 cases per 100,000 (Stewart et al., 2018). The case count decreased by 1.8% from 2016 to 2017, and the rate declined by 2.5% over the same period (CDC, 2016b). These decreases are consistent with the slight decline in TB seen over the past several years. According to the National Tuberculosis Surveillance System (2017), the rate of TB among non-U.S. born persons in 2017 was 15 times the rate among U.S.-born persons. Among non-U.S. born persons, the highest TB rate among all racial/ethnic groups was among Asians (27.0 per 100,000) followed by non-Hispanic blacks (22.0 per 100,000). The most TB cases in U.S.-born persons were reported among blacks (37.1 per 100, 000) followed by non-Hispanic Whites (29.5 per 100,000) and persons experiencing homelessness (4.3 per 100,000; CDC, 2016b).

Ongoing efforts to prevent TB transmission and disease within the *United State of A*merica stay crucial to endured progress towards TB elimination. Testing and treatment of populations maximum at risk for TB disease and LTBI, together with persons born in countries with high TB prevalence and persons in high-risk congregate settings, are essential components of this effort (Bibbins-Domingo et al., 2016).

Georgia & Fulton County prevalence. Georgia reported 573 TB cases in 2001 and ranked seventh in the nation in TB case rates and 321 cases in 2015 (GDPH, 2014).

This represents a 4% decrease from the 334 TB cases reported in 2014. TB case numbers have decreased 65% since 1991 when the peak of a resurgent period of tuberculosis occurred in Georgia. Despite this decrease, 301 TB cases were reported putting Georgia fifth highest in the number of TB cases (2.9 per 100,000 populations) and ranked in the eighth in 2015 (GDPH, 2016). Among the 159 counties in Georgia, four counties in the metropolitan Atlanta area and their corresponding health districts reported the highest number of TB cases in 2015 (GDPH, 2016). Fulton County's 2014 TB cases rate was almost three times the national TB case rate of 6.2 per 100,000 population (GDPH, 2015) which constituted 88% of all reported cases of TB outbreak in the state, and more than half in the country (FCBOH, 2017; GDPH 2014). Fulton County reported the most TB cases in Georgia and of this, the highest proportion of TB cases were in African American individuals compared with all other counties in the state (GDPH, 2014). African Americans represent 45% of Fulton County's population yet accounted for 81% (109/135) of the county's TB cases in 2014 (GDPH, 2016).

TB prevalence in individuals who are homeless. In the United States, 1% of the population experiences homelessness in a given year but more than 5% of people with TB report being homeless within the year before their diagnosis (CDC, 2016). Among *U.S*-born TB cases, homelessness represents a risk factor (Salinas et al. 2016) compared with nonhomeless individuals. PEH have a tenfold risk of TB disease in comparison to the general population (Bamral et al. 2013).

Atlanta has a population of about approximately 5.7 million, with a homeless population estimated at 4,317 in 2015 (Georgia Department of Community Affairs, 2015;

United States Census Bureau, 2015). The metropolitan area is primarily located in Fulton County, where there was an average of 55 cases of TB per year from 2008 to 2015, and 36% of TB case occurred among PEH (Powell et al., 2017). Furthermore, TB outbreaks among the homeless population are associated with increased TB transmissions resulting in larger outbreak cluster of 110 outbreak cases in Georgia (Yen, 2016). Seventy eight % were cultured confirmed and isoniazid-resistant which was being seen in homeless shelters, eight outbreak-associated patients had stayed overnight or volunteered extensively in a homeless shelter (Powell et al. 2017).

Homelessness is associated with greater TB transmission (Lindquist et al. 2013), and homeless-associated outbreaks can be substantial, involving large numbers of patients and multiple sites of transmission (CDC, 2017b; Althomsons et al., 2018). Homeless TB patients had over twice the odds of not completing treatment and of belonging to a genotype cluster (Bamrah et al., 2013). This led to a recent 110 outbreak case of TB among PEH in homeless shelters in Fulton County GA (Powell et, al., 2017).

Homelessness increases the risk of TB due to exposure in crowded shelters, and its association with substance use, and HIV infection, which lowers immunity (CDC, 2016a). It is critical to diagnose LTBI in patients to provide treatment, prevent disease progression.

Treatment of TB

TB disease can be treated, by taking several drugs for 6 to 9 months. There are 10 drugs currently approved by the U.S. Food and Drug Administration for treating TB and the first-line anti-TB agents that form the core of treatments regimens include Isoniazid

(INH), Rifampin (RIF), Ethambutol (EMB), and Pyrazinamide (PZA) (CDC, 2017a). The primary drugs used to treat LTBI include isoniazid (INH), rifapentine (RPT), and rifampin (RIF).

While all the regimens are effective when used correctly, healthcare providers should prescribe the more convenient shorter regimens when possible (CDC, 2017a). A major challenge facing is the treatment of TB has been the emergence of drug resistance TB (DR-TB). In 2015, 450,000 people were estimated to have developed multi-drug-resistant TB (MDR-TB;WHO, 2016a). This has been mainly because of the use of inadequate or incorrect treatment by health workers or patients not following directions for drug treatment exactly or completely (Abubakar et al., 2013; Glaziou et al. 2013; Sharma & Mohan, 2013; Zhang & Yew, 2015). Mutant strains of the organisms which are resistant to the conventional TB drugs develop when treatment regimens are not followed exactly or correctly (Glaziou et al., 2013). It is estimated that approximately 3.6% of new TB cases and 20.2% of previously treated TB cases have DR-TB (Glaziou et al., 2013).

There are several varieties of DR-TB, but the most serious ones are MDR-TB and xtensively drug-resistant TB (XDR-TB). MDR-TB is said to be present when the TB bacilli are resistant to at least isoniazid, and rifampicin, while extensively drug-resistant (XDR)-TB occurs when the organisms are resistant to isoniazid and rifampicin and at least one fluoroquinolone, and one injectable second-line anti-TB drug (Abubakar et al., 2013; D'Ambrosio et al., 2015; Horsburgh et al., 2015; Zhang & Yew, 2015).

D'Ambrosio et al., (2015) reported that a major challenge with DR-TB treatment is poor treatment outcomes among patients with the condition.

Testing and Treatment Barriers in Populations that are Homeless

An average of 29% of persons with TB in Fulton County reported experiencing homelessness within the 12 months before their TB diagnosis (GDPH, 2014). Early TB infection diagnosis in homeless populations can be challenging because many have barriers to accessing health care including lack of health insurance, difficulty paying for care, lack of transportation, and lack of information needed to access care (CDC, 2016). Testing, diagnosis, and treatment assessment are critical in TB disease elimination efforts, and this often becomes complex in populations that are homeless and transient (Parriott et al., 2018).

Barriers to testing and diagnosis.

The TST requires that persons, who have tests placed, return within 48 to 72 hours to have the test read. Coming back to the test site within a fixed period can be challenging for PEH who may relocate frequently, are financially stressed, and may have mental health disorders (CDC, 2016b). In contrast, interferon gamma release assays (IGRA) are performed in a lab and do not require any additional contact with the person being tested to obtain valid test results as the test results are available in the lab at a later time (Susan et al., 2014). However, persons who test positive must be located to inform them of their test results and coordinate follow-up care, which can be very challenging for persons without fixed addresses or contact information. Researchers noted the problem that hard to reach population such as PEH faces accessing healthcare facilities

(Croft & Hayward, 2013; Wannheden et al., 2013). PEH were generally aware of untreated TB being potentially fatal (Gerrish, Ismail & Naisby, 2010; Wieland et al., 2012).

Barriers related to TB stigma. TB-related stigma is a barrier to TB testing and treatment adherence and as an important concern for people diagnosed with TB and their families (Coreil et al., 2010). TB-related taboos may cause stigmatizing attitudes among community members (Gerrish, Ismail and Naisby, 2013; Wieland et al., 2012) and the perception of a link between TB and HIV also may results in stigmatization (Coreil et al., 2010). This stigma (perceived or real) may result in a delay in seeking the diagnosis as well as not initiating treatment and/or nonadherence to treatment (Craig, 2016).

Barriers related to lack of knowledge/information about TB/LTBI.

TB continues to be prevalent and therefore included in the international TB control efforts (Moya et al., 2014). Researchers have found disparities in knowledge about TB/LTBI among those who are homeless versus those who are not homeless when compared with (Dias et al., 2017; Cheng et al., 2014; Coffman et al., 2012; Gonza'lez et al,. 2009). Health literacy is defined as the basic information that individuals have to obtain process and comprehend, to make the appropriate health decision (National Network of Libraries of Medicine, 2013). PEH faces many stressors in their lives, which contribute to low health literacy with TB health issues (e.g., medication, disease prevention, and treatment). Additionally, several researchers have found the negative effects of illiteracy

And lower knowledge of TB on the treatment process for PEH (Getahun, 2015; Doosti et al., 2015; Bagheri et al., 2017; Bisallah et al., 2018). This lack of knowledge also affects how PEH in shelters know the warning signs and symptoms of TB to seek appropriate health care (Bamrah et al., 2013). Since PEH has a strong link to TB (Parriott et al., 2018), it is important that homeless shelters staff are trained on early detection of TB between PEH in homeless shelters to prevent the spread of TB (GDPH, 2016; Preetha et al., 2016).

Summary and Conclusions

Even though the general number of TB cases keeps on declining nationally (CDC, 2013b) the disease remains a major public health threat in the United States (CDC, 2013b). The case rate in PEH remains unsuitably high compared with nonhomeless individuals (Bamrah, 2013). Several literature reviews provided a detailed representation of the barriers relating to TB diagnosis, treatment; TB stigma; lack of knowledge/ information about TB/LTBI within vulnerable populations (Holmes et al., 2017; Parriott et al., 2018). The SEM permitted an understanding of multilevel social and biophysical factors that predict the prevalence of TB and nonadherence to treatment completion among individual in the population under study (Bronfenbrenner, 1994). Using SEM in the study guided an evaluation of TB prevalence and nonadherence to treatment completion among homeless persons in homeless shelters in Fulton County. Although the aforementioned research regarding TB in the homeless population illuminates important findings, I have found no research that has examined the predictive relationships between sociodemographic and LTBI treatment completion in this population. Also, no specific

contextual or individual risk factors influencing high TB rates among PEH in Fulton County have been studied. This type of study may help program designers target specific demographic characteristics to increase treatment completion rates. In Chapter 3, a detailed discussion of the quantitative methodology for this research study is described. This section focuses on describing the research study procedures, study design, study setting, sample size, data collection, and analysis.

Chapter 3: Research Methods

Introduction

Several researchers have investigated the problem of TB in the United States (Andrew et al., 2010; Butler & Carr, 2013; Yuen et al., 2016). The majority of TB cases are centralized in 48 U.S. cities that account for 36% of all TB cases in the United States (CDC, 2018). The TB incidence rate in these cities (i.e., 12.1 per 100,000 residents) is higher than the national average of 3.2 per 100,000 residents (Stewart et al., 2018). While some cities have seen a decrease in the number of TB cases in the past few years, Fulton County, GA has not seen this decrease (GDPH, 2014). Fulton County's 2014 TB case rate was almost 3 times the national TB case rate, which constituted 88% of all reported cases of TB outbreak in the state and more than half of all cases in the country (FCBOH, 2017; GDPH, 2014). An average of 29% of persons with TB in Fulton County reported experiencing homelessness within the 12 months before their TB diagnosis (GDPH, 2014). Therefore, the problem that I addressed in this research study was the rate of TB infection in those who are homeless in Fulton County, GA to address the ongoing health concerns for that population as well as the risk to the community due to this highly infectious disease.

The purpose of this quantitative research study was to examine the predictive relationship between sociodemographic factors (i.e., age, sex, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among PEH who reside in homeless shelters in Fulton County. The findings from this study have the potential to enable public health practitioners at the county, state, and federal levels to

further develop interventions and prevention methods that are aimed at inhibiting the spread of TB and increase treatment completion rates. This includes the spread of the disease not only among the study population but also the overall population at the state and national levels.

In Chapter 3, I describe the quantitative methodology for this research study. This includes information on the variables, research design and rationale, and methodology that was used. I also discuss threats to validity and ethical considerations.

Research Design and Rationale

The research problem for this study was that the contextual predictors for the high rate of TB infection in PEH in Fulton County, GA were not clearly understood. The independent variables were sociodemographic factors, including age, gender, shelter type, substance abuse status, and treatment medication type. The dependent variable was treatment completion status in the same target population.

I used a quantitative, correlational research design of a cross-sectional nature because I attempted to statistically determine if a relationship exists between variables. Correlational research is a type of nonexperimental research in which the researcher measures the statistical relationship between two or more variables (i.e., the correlation; Paul et al., 2015). This kind of research design allows researchers to determine the strength and direction of a relationship so that later studies can narrow the findings down and, if possible, determine causation experimentally (Paul et al., 2015). Important elements of correlational studies are that they are generally quick and easy to conduct, have fewer ethical issues, and are generally inexpensive (Paul et al., 2015). However,

correlational research only uncovers if there are relationships but cannot establish causation.

Cross-sectional studies are observational, meaning that researchers record information about their subjects without manipulating the study environment (Setia, 2016). The benefit of a cross-sectional study design is that it allows researchers to compare many different variables at one point in time; however, cross-sectional studies generally do not provide definite information about cause-and-effect relationships but are used to describe an element of a social phenomenon in a population (See iwh.on.ca, 2015). This is because such studies offer a snapshot of a single moment in time but do not consider what happens before or after the snapshot is taken (Seita, 2016).

Another research design I considered using in this study was the nonequivalent group design. The nonequivalent group design is a between-subjects design in which participants have not been randomly assigned (Campbell & Stanley, 2015). Using the nonequivalent group design may reduce the time and resources required in the study because extensive prescreening and randomization is not required or utilized (Bernard & Bernard, 2012; Trochim, 2006). However, statistical analyses may not be meaningful due to the lack of randomization and the threats to internal validity (Campbell & Stanley, 2015). For this reason, I did not use this type of research design for this study.

Experimental research designs, often called true experiments, are concerned with the examination of the effect of an independent variable on the dependent variable, where the independent variable is manipulated through treatment or interventions and the effect of those interventions is observed on the dependent variable (Campbell & Stanley, 1963;

Creswell, 2013). However, this research design relies on statistical analysis to disprove a hypothesis (Bernard & Bernard, 2012; Punch, 2013). For this reason, I did not use this research design for this study.

Methodology

Population

The population for this study was PEH between 18 years old and older, residing in homeless shelters in Fulton County, GA. Based on the GDPH (2014) report, 573 TB cases in 2001 were reported in Georgia, and it ranked seventh in the nation in 2015 with 321 reported cases. Fulton County has a population of 1.041 million (U.S. Census, 2018), and in 2017, the number of PEH was estimated to be 13,790 (GDPH, 2014). Of those 13,790, approximately 2,336 resided in shelters (Partners for Home, 2018). There have been approximately 55 cases of TB reported per year in Fulton County between 2008 and 2015 (GDPH, 2015). Approximately 36% of these were among people who were homeless (Powell, 2017). The 2014 TB rate in Fulton County was almost 3 times the national TB case rate of 6.2 per 100,000 populations (GDPH, 2015).

Sampling and Sampling Procedures

Sampling strategy. I used a purposeful convenience sampling method in this study. Purposeful sampling involves the selection of participants who meet specific criteria (Frankfort-Nachmias & Nachmias, 2008). Purposive sampling is a nonprobability sampling method, and it means that the participants chose (or cases from the data set) meet specific criteria (Palinkas et al., 2015). Purposive sampling is one of the most cost- and time-effective sampling methods available (Palinkas et al., 2015). This type of

sampling technique can be effective in exploring anthropological situations where the discovery of meaning can be benefit from an intuitive approach (Lewis et al., 2012).

Convenience sampling is a type of nonprobability or nonrandom sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate, are included for the study (Ilker et al., 2016; Zhi, 2014). Convenience sampling is the easiest, least time-intensive, and least expensive type of sampling to implement (Lewis et al., 2012). However, results from a convenience sampling study can only be generalized to a group that shares the same characteristics (Frankfort-Nachmias & Nachmias, 2008). Convenience samples may include small numbers of underrepresented sociodemographic subgroups (e.g., ethnic minorities), which may result in insufficient power required to detect subgroup differences within a sociodemographic area (CITE). These underrepresented sociodemographic subgroups may introduce modest amounts of variation into the sample, enough variation to produce unstable statistical influence in the analyses but not enough variation to control statistically (Marc et al., 2013).

In this study, I used a de-identified data set of medical records of routine care provided to PEH that were screened for TB infection (using the QuantiFERON Gold-in-Tube test or TST) and individuals treated for LTBI between January 2014 and December 2016 stored in an active data set from a public health clinic in Fulton County. I obtained approval of Walden University Institutional Review Board (IRB) before requesting access to the data set. Once obtained, the data set was stored in a password-protected

computer. Participants who did not meet the specified inclusion criteria were not included in the eligibility list for this study and were not included in the statistical analysis. The inclusion criteria for sample or participant selection were:

- The participants must have been living in a homeless shelter.
- The participants must be 18 years old and older.
- Participants had to be diagnosed with LTBI between January 2014 and December 2016.
- Participants had to be assigned either DOT or SAT between January 2014 and December 2016.
- DOT/SAT results must have been included in the data set (taken 3 months after treatment assignment)

Cases that did not meet these criteria were excluded from the data sample.

Sample size calculation. Statistical power is the probability of obtaining a test statistic, such as ratio, that is large enough to reject the null hypothesis when the null hypothesis is false (Rebecca, 2013). Researchers use the following four, interrelated elements when conducting statistical analyses so that they can arrive at their conclusion: (a) sample size (i.e., the number of research participants involved in the research study); (b) effect size (i.e., the magnitude of the experimental effect); (c) alpha level (i.e., the probability that the observed test finding is due to chance); and (d) power (i.e., the probability that researchers observe a treatment effect when one exists; Trochim, 2006). Ensuring appropriate sample size estimation improves or strengthens the power of the study (Burkholder, 2009).

I used G*Power software to estimate the statistical power in this study. For G*Power estimation, the beta (i.e., Type II error at 100% power) value was set at 20% (i.e., 0.2), and the statistical power value was set at 80% (i.e., 0.80). For a two-tail test, the predetermined effect size or the power estimation was set at a small level (i.e., 0.2). I set the parameters in the tool to (a) test family = *z* test, statistical test = logistic regression, and alpha = 0.05. Based on the power estimation shown in Table 1 and Figure 1, the minimum sample size required to conduct this study was calculated at 323 participants. The Type II error and power was the criteria used to assess whether the sample size was sufficient for the statistical analysis (see Table 1).

Table 1

*G*Power z Tests and Logistic Regression Output*

Options:	Large sample z-Test, Demidenko (2007) with var correlation		
Analysis:	A priori: Compute required sample size		
Input:	Tail(s)	=	Two
	Odds ratio	=	2.0
	Pr(Y=1|X=1) H0	=	0.2
	α err prob	=	0.05
	Power (1-β err prob)	=	0.80
	R^2 other X	=	0
	X distribution	=	Normal
	X parm μ	=	0
	X parm σ	=	1
Output:	Critical z	=	1.9599640
	Total sample size	=	323
	Actual power	=	0.8028456

Procedures for Recruitment, Participation, and Data Collection

Initial data collection. All TB screenings for PEH who receive services in shelters are performed by trained disease investigation specialists at various Fulton County homeless shelter locations on a routine basis (FCBOH, 2016). Clients determined to be eligible for LTBI treatment are offered either 4 months of RIF regimen or 3 months of RPT-INH (FCBOH, 2016). The shelter residents are routinely screened for TB through

the Fulton County Homeless health team. During the intake process all information received are documented in the electronic system (FCBOH, 2016).

The clinic uses the Georgia State Electronic Notifiable Disease Surveillance System (SENDSS) to capture data about TB cases reported to the CDC Bureau of Tuberculosis. This system is used to store data on all residents of homeless shelters located within Fulton County who were screened for TB infection in the field (i.e., at shelter locations). The clinic uses the Mitchell and McCormick electronic medical records system for routine patient care records. Data quality in Mitchell and McCormick and SENDSS are Health Insurance Portability and Accountability Act (HIPPA) protected data.

Secondary data access. An initial GDPH IRB application was sent by me via e-mail to the IRB coordinator/chair to request their permission to access the data that pertains to the study (see Appendix A). The permission request forms included a request for descriptive information regarding the purpose of the study and how it would ultimately serve to reduce the risk of TB disease reactivation in Fulton County, GA. Once I received permission through the GDPH and Walden University IRBs, the agency gave me a password-protected thumb drive that included the de-identified data set cases that met the inclusion criteria and the variables of my study.

It was noted that secondary data are the data that have been already collected and readily available from other sources. The most obvious advantage of the secondary analysis of existing data was that it allows researchers access to large samples, can save researchers time and money, and this type of data collection method does not require that

potential participants are contacted directly by the researcher which limits potential ethical issue with protected participants (Cheng & Phillips, 2014; Kelder, 2005). However, secondary data are not collected originally to address the particular research question of this study or to test the particular hypothesis so data may be incomplete or not collected in line with the research questions of the current study (Cheng & Phillips, 2014).

Instrumentation and Operationalization of Constructs

As secondary data was utilized for this study, there were no researcher created or published instruments that was used to collect data. Below are the operationalization's for the variables that was used in this study (see Table 2 and Table 3).

Table 2

Independent Variables

Variable	Coding
Gender	0=male 1=female
Age	Actual age in years
Shelter type	0=Transitional 1=Recovery
Substance abuse status	0=No substance abuse history 1=Substance abuse history

Medication Type	0=DOT
	1=SAT

Table 3

Dependent Variables

Variable	Coding
Treatment Completion Status	0=Treatment not completed 1=Treatment completed

Data Analysis Plan

My research data was analyzed using IBM SPSS Statistics, Version 25. This software was applied complying with policies and guidelines established by Walden University. Data editing and cleaning are essential steps in data processing that researchers should perform preceding data analysis (Frankfort-Nachmias & Nachmias, 2008). I performed these procedures to the extent possible with secondary data.

Data cleaning involves implementation strategies to prevent study errors before and after they occur (Osborne, 2013). Prevention strategies can reduce error rate but do not eliminate errors (Osborne, 2013). Many data errors could be detected incidentally during activities such as (a) during data collection or entry, (b) data transformation, extraction, and transfer, (c) data exploration and analysis, (d) data peer review (Osborne, 2013). Data cleaning involves repeated cycles of the verification and validation process (Van den, Broek et al., 2005). As patterns of errors are identified, data collection and entry procedures were adapted for data validation to correct identified error and reduce future data mistakes (Osborne, 2013). For this study, I kept all the relevant variables in the data set that was useful in the analysis of the posed researched questions. Then I recoded the

variables to align with the level of measurements (nominal variable) specified in the research questions. If the variables are aligned with the level of measurement intended, there was no need to recode the variable.

The data analyses completed was done to answer the following research questions and to make determinations on their related hypotheses:

RQ1: What is the predictive relationship between sociodemographic factors (age, gender, shelter type, substance abuse status), medication type (DOT versus SAT), and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection?

$H1_0$: There is no statistically significant predictive relationship between sociodemographic factors (age, gender, shelter type, substance abuse status), medication type (DOT versus SAT), and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection.

$H1_a$: There is a statistically significant predictive relationship between sociodemographic factors (age, gender, shelter type, substance abuse status), medication type (DOT versus SAT), and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection.

RQ2: What is the difference between adherence to TB treatment by medication type (DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection?

$H2_0$: There is no statistically significant difference between adherences to TB treatment by medication type (DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection.

H*2a*: There is a statistically significant difference between adherences to TB treatment by medication type (DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection.

Descriptive statistics. To understand the characteristics of the sample for the study, descriptive statistics was analyzed. This included the distribution/frequencies of each of the groups in each of the variables. Total sample sizes for each variable, group within each variable and the percentage of that variable that each group encompasses was included.

Chi-square. Chi-square analyses was conducted to determine whether there were statistically significant differences in the dependent variable (treatment completion) between the independent variable groups such as gender (males versus females), shelter type (transitional versus recovery), substance abuse status (no substance abuse history versus substance abuse history), and treatment type (DOT versus SAT;Explorable, 2009). This was done to add additional information about the difference between groups within the independent variables about the dependent variable to provide a better picture of the sample used in the study. Also, chi-square analyses was completed to answer RQ2.

Correlations. Correlations between all of the variables were calculated to determine if any of the variables were highly correlated to one another. This information was used to determine if multicollinearity may be an issue in the multiple logistic

regression analysis. Multicollinearity means that two of the variables are highly correlated with one another and inclusion of both variables may result in that interaction is being magnified in the analysis which could cause false results. Therefore, if two variables are highly correlated with one another ($r = 0.6$; Shieh, 2010), then one of these variables was removed from the multiple logistic regression models to ensure that multicollinearity was not an issue in the analysis.

Multiple logistic regression (RQ 1). Multiple logistic regressions was used to determine the predictive relationship via the calculated statistical significance and odds ratios between demographic factors (age, gender, shelter type, substance abuse status) medication type (DOT versus SAT) and treatment completion among (PEH). The dependent variable treatment completion is binary (0/1) in nature which is necessary for a multiple logistic regression analysis to be appropriate (McDonald, 2014). If there are statistically significant relationships, the researcher is then able to interpret the odds ratio (likelihood) associated with that independent variable (McDonald, 2014). An odds ratio is a predictive statistic that indicates an increase of one unit or level in the independent variable what the odds of the dependent variable occurring is (Szumilas, 2010). And if there is evidence of a lack of goodness of fit, the researcher will manipulate the models as appropriate — goodness of Fit test for logistic regression, especially for risk prediction models (Hosmer, 2013).

Threats to Validity

External Validity

External validity is the degree to which the conclusions in a study would hold for other researchers in other places and at other times (Trochim, 2006) External validity is considered in a study because it indicates if a causal relationship can be generalized to different measures, persons, settings, and times (Steckler & McLeroy, 2008). Threats to validity from extrinsic factors may arise from the fact that participants eligible for inclusion in the study during the study may not be eligible for another study due to PEH are transient. PEH who received treatment for LTBI and covered during the study period may no longer be residing in Fulton County. This may lead to underestimation of the study findings. An additional threat to external validity was related to differences in diagnosis patterns since tools used to diagnose LTBI only detect the presence of an immune response to TB (Ling Lin & Flynn, 2010). PEH that was vaccinated with (BCG) before migrating to the United States are likely to be misdiagnosed with a false positives TB result (Chee, Lange, Sester, & Zhang, 2013).

Internal Validity

Internal validity is the approximate truth about inferences regarding cause-effect or causal relationships in a specific study (Trochim, 2006) internal validity is considered in a study because it gauges how strong the research method is in the study. Completion of at least 80% of prescribed doses of LTBI treatment may be deemed successful completion (CDC, 2018d). However, healthcare provider discretion may be used to determine treatment completion which may potentially impact the research by producing

a variance in the discharge diagnoses. Additionally, the internal validity of this research may also be influenced by the secondary nature of the data being analyzed. The data in this study was collected for a different purpose and only the previously collected data was available for the analysis. Although the FCBOH TB program does perform data quality checks at the time of data entry, data was not validated, nor was additional follow-up information been collected.

Construct and/or Statistical Conclusion Validity

Construct validity refers to the degree to which inferences can legitimately be made from the operationalization in your study to the theoretical constructs on which those operationalizations were based on statistical tests (Trochim, 2006). This validity is considered because it measured how reasonable the research or experimental conclusion was (Trochim, 2006). Intrinsic and extrinsic factors that threaten the internal and external validity of my study was controlled by stratification of the study observations by treatment type. It was not possible to draw a random sample as all study observation cases was included in the study (Creswell, 2013) Additionally, it was important I worked with the database archivist to ensure that the data for the study was accurate, reliable, precise, unbiased, valid, and appropriate (Frankfort-Nachmias & Nachmias, 2008).

Ethical Considerations

I did not have any direct contact with participants. Therefore, there were limited ethical concerns including potential harm to individual subjects and issues of return for consent (Tripathy, 2013). Information and data related to this research was not requested until after Georgia Department of Public Health, and Walden University IRB approval is

sought and obtained. Despite the requested dataset being de-identified, its original proximity to HIPPA heightened measures to protect the data (HHS, 2018). Although the SENDSS database in which the research dataset derived, contained Protected Health Information. I requested the FCBOH TB program epidemiologist to remove potentially identifiable information from the research dataset. This approach ensured research participants not identified from the research data file. All data that was collected for this research was stored and password protected on my laptop. Access to these data required the use of a password that is only known by me. The only other individuals who potentially have access to the data are my committee members. All data will be discarded after 5 years from the date data collection process is completed.

Summary

In Chapter 3, the overview of the research design and rationale, methodology, and threats to validity were discussed. This Chapter presented very important information concerning the ethical considerations that must be considered for the study participants. In Chapter 4, data collection and the results presented and discussed. In the final Chapter 5, the interpretation of the study findings, limitation of the study, recommendations, implications, and conclusions of the study was addressed.

Chapter 4: Results

Introduction

The purpose of this study was to examine the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among PEH treated for LTBI living in Fulton County, GA homeless shelters aged 18 years old and above. I developed the following research questions and corresponding hypotheses to guide this study:

RQ1: What is the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness treated for latent tuberculosis infection?

$H_0$1: There is no statistically significant predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness.

H_a1: There is a statistically significant predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among persons experiencing homelessness.

RQ2: What is the difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness treated for latent tuberculosis infection?

$H_0$2: There is no statistically significant difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness.

H_a2: There is a statistically significant difference between adherences to TB treatment by medication type (i.e., DOT versus SAT) among persons experiencing homelessness.

This chapter contains the data collection process used as well as the results of the data analyses I completed.

Data Collection

My research proposal was approved by both the Walden University IRB and the GDPH. The GDPH approval can be found in Appendix A. Efforts to collect data commenced after IRB approval was received on May 7th, 2019. The IRB approval number is 05-07-19-0499415. I accessed the de-identified data within a 4-day period from May 9th through May 14th, 2019. There was no notable discrepancy in the data collection plan from what was stated in Chapter 3. The archival LTBI database included deidentified health records (i.e., where numbers replaced names) of PEH of any age, gender, and substance abuse status who resided in a shelter and were treated for LTBI between January 2014 and December 2016. The data set was in a spreadsheet stored in a password-protected flash drive. I first performed a data quality check to ensure

consistency and completeness of the data set and found no missing data in the data set. Applying the sampling and exclusion criteria outlined in Chapter 3, data for a total of 323 PEH who met the criteria were included in the data set sample. I recoded the values of the independent variables and dependent variables as needed to match the coding proposed in Chapter 3 in Table 2.

Results

Demographics

The demographics of the respondents included gender, age, medication type, shelter type, and substance abuse status and are summarized in Table 4. Males made up 87.3% of the sample, while 57.6% of the sample resided in a transitional shelter setting, 64.4% received DOT, and 59.1% did not have a history of substance abuse.

Table 4

Demographic Characteristics of Sample

Variable	Category	*N*	Percent
Gender (IV)	Male	282	87.3
	Female	.41	12.7
Age (IV)	20–29	21	6.5
	30–39	49	15.2
	40–49	74	22.9
	50–59	121	37.5
	60–69	54	16.7
	69+	4	1.2
Medication type (IV)	DOT	208	64.4
	SAT	115	35.6
Shelter type (IV)	Transitional	186	57.6
	Recovery	137	42.4
Substance abuse status (IV)	No	191	59.6
	Yes	132	42.4
Treatment outcome (DV)	Not completed	143	44.3
	Completed	180	55.7

Note. $N = 323$.

Assumptions

Multicollinearity. I calculated the correlations between all of the independent variables using the Pearson's correlation coefficient test in SPSS in order to determine if multicollinearity existed between the variables. According to Field (2013), if any of the variables had a Person's correlation coefficient (r < +/-) of .6 or higher, one or more of the variables should be removed from the multiple logistic regression in order to ensure that multicollinearity is not an issue in the analysis. During the correlation testing, none of the variables were highly correlated at this level (see Table 5); therefore, all variables were used in the regression analysis.

Table 5

Pearson Correlation Results

	Gender	Age	Medication type	Shelter type	Substance abuse status	Treatment outcome
Gender	1	-.060	.070	.106	-.014	.0.91
Age	-.060	1	.025	-.039	-.002	.208**
Medication type	-.070	.025	1	.055	-.013	.012
Shelter type	.106	-.039	.055	1	.000	-.030
Substance abuse status	-.014	-.002	-.013	.000	1	-.426**

Note. N = 323.
* = Statistically significant at p < .05 level; **=Statistically significant at p < .01 level

Research Question 1

I conducted a multiple logistic regression analysis using the enter method. This was appropriate because there were a small set of predictors in the analysis, and all the independent variables were entered into the equation at the same time not knowing which independent variables created the best prediction equation (see Leech, Barrett, & Morgan, 2008). Age (p = .000) and substance abuse status (p = .000) were the only independent variables related to treatment completion status at statistically significant levels.

Interpretation of the ExpB (i.e., odds ratio) for these variables indicated that, for each increase of 1 year in age, an individual was 1.05 times more likely to complete LTBI treatment (ExpB = 1.047). Those individuals who have a history of substance abuse were 0.14 times more likely to complete LTBI treatment (i.e., less likely) than those who do not have a history of substance abuse. Therefore, I failed to reject Null Hypothesis 1 because only age and substance abuse status were related to the dependent variable at statistically significant levels.

Table 6

Variables in the Equation

							95% CI For EXP(B)	
	B	*SE*	Wald	*df*	Sig	ExpB	Lower	Upper
Gender	-.633	.381	2.762	1	.097	.531	.252	1.120
Age	.046	.012	15.320	1	.000**	1.047	1.047	1.071
Medication	-.033	.269	.015	1	.903	.968	.571	1.641
Shelter	-0.64	.261	.060		.806	.938	.562	1.564
Substance abuse	-1.981	.261	55.806	1	.000**	.138	.082	.232
Constant	-1.039	.592	3.086	1	.079	.354		

* = Statistically significant at $p < .05$ level; ** = statistically significant at $p < .01$ level

Research Question 2

I conducted a chi-square analysis to determine if there was statistically significant difference in adherence to TB treatment between medication type groups (i.e., DOT versus SAT). Of the 208 participants who were prescribed DOT, a total of 55.3% (n = 115) completed treatment, and of the 115 prescribed SAT, a total of 56.5% (n = 65) completed treatment (see Table 7). There was no statistically significant difference in adherence to TB treatment between the two medication types (p = .831; See table 8). Therefore, I failed to reject Null Hypothesis 2.

Table 7

Treatment Outcome Crosstabulation

		Treatment not completed	Treatment completed	Total
DOT	Count	93	115	208
	Expected count	92.1	115.9	208.0
	% within medication type	44.7%	55.3%	100.0%
	% within treatment outcome	65.0%	63.9%	64.4%
SAT	Count	50	65	115
	Expected count	50.9	64.1	115.0
	% within medication type	43.5%	56.5%	100.0%
	% within treatment outcome	35.0%	36.1%	35.6%
Total	Count	143	180	323
	Expected count	143.0	180.0	323.0
	% within medication type	44.3%	55.7%	100.0%
	% within treatment outcome	100.0%	100.0%	100.0%

Table 8

Chi-Square Tests

	Value	*df*	Asymptotic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Person chi-square	0.46	1	.831		
Continuity correction	.009	1	.923		
Likelihood ratio	.046	1	.831		
Fisher's exact test				.907	.462
Linear-by-linear association	.046	1	.831		
N of valid cases	323				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 50.91
b. Computed only for 2x2 table

Summary

I designed this study to examine the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among PEH treated for LTBI as well as the difference in treatment completion between medication types used.

Research Question 1 was designed to examine the predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among PEH treated for LTBI. I failed to reject the null hypothesis overall; however, there were some statistically significant predictive relationships. Age (p = .000) and substance abuse status (p = .000) were the only independent variables related to treatment completion status at statistically significant levels. The ExpB (i.e., odds ratio) for these variables indicated that for each increase of 1 year in age, an individual was 1.05 times more likely to complete LTBI treatment (ExpB = 1.047). Individuals who have a history of substance abuse were 0.14 times more likely to complete LTBI treatment (i.e., less likely) than those who do not have a history of substance abuse.

Research Question 2 was designed to determine if there was statistically significant difference in adherence to TB treatment between medication type groups (i.e., DOT versus SAT). I failed to reject the null hypothesis because there was no statistically significant difference between adherences to TB treatment between medication types groups. In Chapter 5, I present a discussion of the results, my recommendations, and the implications for positive change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Homelessness has historically been found to be a strong risk factor in developing TB disease (GDPH, 2017). An average of 29% of persons with TB in Fulton County reported experiencing homelessness within the 12 months before their TB diagnosis (GDPH, 2014). Therefore, the problem that I addressed in this research study was the LTBI treatment completion rate of PEH in Fulton County, GA to address the ongoing health concerns for that population as well as the risk to the community due to this highly infectious disease. Although research has been conducted regarding the risks associated with the variables of age, gender, substance abuse status, and medication type (i.e., DOT versus SAT and TB infection rates in the United States over the last 7 years (i.e., Azevedo et al., 2015; Bamrah et al., 2013; Dolla et al., 2017; Laurenti et al., 2012), few researchers have focused on treatment completion among the homeless population in Fulton County, GA (Holland et al., 2019; Onwubiko et al., 2019; Powell et al., 2017).

The purpose of my correlational, cross-sectional study using secondary data was to examine whether there was a statistically significant predictive relationship between sociodemographic factors (i.e., age, gender, shelter type, and substance abuse status); medication type (i.e., DOT versus SAT); and treatment completion among PEH treated for LTBI in Fulton County, GA. In addition, I also analyzed if there was statistically significant difference in adherence to TB treatment between medication type groups (i.e., DOT versus SAT). The majority of TB cases among PEH in the United States are attributed to reactivation of LTBI (Yuen et al., 2016). Several researchers have revealed

that treating LTBI before reactivation and ensuring high rates of LTBI treatment completion could lead to effective prevention and control of TB disease, potentially decreasing the global morbidity and mortality rate (CDC, 2015; Nuzzo et al., 2015; Powell et al., 2017).

I selected Fulton County, GA as the location for the sample because its homeless population accounts for 36% of the TB cases in the city (see Powell, 2017). I used secondary data of de-identified LTBI patient medical records from a public health clinic Fulton County performing analysis through multiple logistic regression and chi-square analyses. Only secondary data from those who met eligibility criteria of being a PEH living in a homeless shelter, 18 years old and older, with a diagnosis of LTBI between January 2014 and December 2016, and assigned to either a DOT or SAT treatment regimen were included in the study. The sample data analyzed included data from 323 individuals.

The results for Research Question 1 indicated that there was no statistically significant relationship between all of the independent variables (i.e., gender, age, medication type, shelter type, and substance abuse status) and treatment completion outcome, so I failed to reject the null hypothesis. However, there were statistically significant predictive relationships between age in years and treatment completion status as well as substance abuse status and treatment completion status. The odds ratio between age and treatment outcome indicated that for each increase 1 year in age, an individual was 1.05 times more likely to complete LTBI treatment (ExpB = 1.047). Individuals who have a history of substance abuse were 0.14 times more likely to complete LTBI

treatment (i.e., less likely) than those who do not have a history of substance abuse. For Research Question 2, I found that there was no statistically significant difference in adherence to TB treatment between the two medication types (i.e., DOT or SAT), so I failed to reject the null hypothesis related to this research question.

Interpretation of the Findings

Interpretation of Findings in Relation to Literature Reviewed

The results indicated that there was a statistically significant relationship between age and treatment completion status as well as between substance abuse status and treatment completion status. Ailinger et al., (2007) found a relationship between age and LTBI treatment completion status with younger patients less likely to complete therapy than older patients. This was similar to the findings of Hirsch-Moverman et al., (2015), who found that those who were older were more likely to complete LTBI treatment. Nyamathi et al. (2008) as well as Hirsch-Moverman et al. found that PEH who engaged in substance abuse are at a higher risk of not completing LTBI treatment, which is also what I found in my analyses.

I was unable to find researchers who used the type of shelter that the participant had access to as a variable in their study of LTBI treatment completion, so I was not able to compare my results related to shelter, which were not statistically significant. I did, however, find several researchers who demonstrated that having access to stable housing options was related to LTBI treatment completion (Aliya et al., 2016; David et al., 2019; Hirsch-Moverman et al., 2015; Powell et al, 2017). I would recommend that if I did further research in the future about this topic that I include access to stable housing

options as an independent variable so I could do comparisons to the works of these other researchers.

My findings regarding the relationship between gender and LTBI treatment completion did not with those of Hirsch-Moverman et al. (2015) because I did not find statistically significant differences in treatment completion between males and females, but the previous group of researchers did. I found a statistically significant relationship between substance use status and LTBI treatment completion status with those who have a history of substance use being less likely to complete treatment. This confirmed the results of Feske and Musser (2013) who found that those with a history of substance abuse were less likely to complete treatment.

I did not find a statistically significant difference in LTBI treatment status between medication types used (i.e., DOT versus SAT). My findings regarding this topic were similar to Belma et al. (2014) and Amrita et al. (2014) who also did not find statistically significant differences in LTBI treatment completion between medication type used. This would bring into question whether what treatment type is used matters when treating LTBI in PEH as other variables/demographics may be more important in determining if an individual will complete treatment or not.

Interpretation of Findings in Relation to Theoretical Framework

The SEM was the theoretical framework used for this study. Theorists have indicated that behavior and health cannot be looked at in isolation and that there is an interdependent network of relationships influenced by internal (i.e., individual) and external (i.e., environmental) factors that influence them (Bradshaw et al., 2013; CDC,

2012a; Sallis & Owen as cited in Blanz et al., 2008). I used the SEM to set the foundation to understand the multilevel social and biophysical factors that predicted the prevalence of TB and nonadherence to treatment completion among individual in the population under study (see Bronfenbrenner, 1994). Previous researchers have cited the SEM as an appropriate conceptual framework for the prevention and control of both infectious and noncommunicable disease (David et al., 2014; Iwelunmor et al., 2016; WHO, 2013b). The WHO (2013b) indicated that age (i.e., an individual factor), homelessness (i.e., community or social relations), HIV coinfection (i.e., a healthcare system intervention), and substance abuse (i.e., a failure of health policy) were predictors of TB disease infection. I found that age (i.e., an individual factor) and substance abuse status (i.e., a failure of health policy) were related to LTBI treatment completion at statistically significant levels.

Public health organizations seek to encourage risk reduction by promoting individuals and community action as well as environmental factors through interventions designed to bring about situational or structural change, such as lobbying for changes in police practices; IJDP, 2018). Policy enabling environment factors also pertain to issues relating to government commitment to healthcare funding, health insurance coverage, and shelter policies that prevent the transmission of TB among homeless populations (CDC, 2016a). For example, homeless shelters could ensure that clients provide a valid TB status card indicating their TB status before admission to protect other residents from being exposed to those who are TB positive (GDPH, 2016). Some researchers have applied the SEM by approaching their investigations from multilevel perspectives

encompassing intrapersonal, interpersonal, environmental, and community factors of influence (Mayne et al., 2015; Reis et al., 2016).

My research findings do align with the construct of this theory that postulates that certain sociodemographic factors exist in socio-ecological environments that contribute or do not contribute to treatment completion. The findings of my study suggest partnering with substance abuse programs, especially those that can assist with temporary or permanent housing in Fulton County so that the information I learned about the relationships between age, substance abuse status, and treatment completion status could be used to focus on those groups that were found to have more difficulty completing treatment than other groups. For example, information about the importance of completing treatment could be presented differently to younger and older PEH with LTBI in ways that are meaningful to that age group. Since those who have engaged in substance use may be less likely to complete treatment, this group may need to be approached differently to point out the risks associated with using substances when getting LTBI treatment or making connections to the more short-term risks associated with not completing LTBI treatment because this may be more meaningful to this group than things that may happen years in the future if they are not treated.

Limitations of the Study

One limitation of my study was the inability to determine type of substance used by participants as well as the level that the participant used the substance. The use of alcohol has been shown to be a key driver of poor TB treatment completion (Andrews et al., 2012; Meyers et al., 2018). Eric (2017) found that an early effective patient screening

and intervention practice reduces the strong relationship between substance abuse and healthcare treatment outcomes. It may be beneficial for future researchers to include a substance use intervention along with the LTBI treatment options to see if this helps increase the chances that an individual with a history of substance use will complete the LTBI treatment regimen, such as drug or alcohol counseling or other intervention programs in tandem with the LTBI treatment.

Another limitation of this study was that it is possible that there might have been individuals with LTBI who received their first treatment in the clinic but were lost to follow up or dropped out of treatment in the shelter. I was not able to know if they completed or did not complete treatment. Being lost to follow up has been found to be a frequent reason for failing to reach treatment completion (Heiss et al., 2009; Ibrahim & Marc, 2019). Gebreweld et al. (2018) indicated that assessing patient healthcare literacy is critical for treatment plan adherence.

Recommendations

The findings of this study have provided a platform for further investigation of the relationship between demographic variables and LTBI treatment completion among PEH populations. Further researchers should study *why* LTBI treatment is not being completed. This could be accomplished through the use of a qualitative methodology where those who did not complete treatment were interviewed about their reasons for not doing so. It may also be beneficial to conduct a mixed methods study where the quantitative factors that I used would be analyzed and combined with qualitative data about why individuals completed treatment or not (see Creswell, 2003).

I did not include health literacy as a variable in my study. This variable could be added in future research through the use of an instrument that is able to measure health literacy, such as a short assessment of health literacy in Spanish and English (see Lee et al., 2010). Health literacy could be measured at the time of being tested for LTBI, when results are given, and after the timeframe of treatment (whether or not treatment was completed). This would be a pre-/posttest research design that could detect changes in health literacy levels that may be related to going through the LTBI testing and treatment process (see Campbell & Stanley, 2001; Darren et al., 2004)

Researchers have shown that substance abuse users continue to be a group at high risk for TB and reduced completion of treatment (Getahun et al., 2013; Pippa et al., 2013). Therefore, I recommend investigation of other potential relationships, such as type of substance abuse, to further demonstrate the role of other potential risk factors for TB among PEH. Further research is necessary to characterize barriers to TB treatment in different geographical areas to quantify the impact of TB diagnostic delay, treatment compliance, and morbidity.

Additional recommendations are related to the potential intrinsic and extrinsic factors that were threats to internal and external validity of my study (see Creswell, 2013). These included the existence of factors that I did not measure and those I was not aware of, such as prior health education and health literacy levels (see Zajacova & Lawrence, 2019) and differences in biological, psychological, and social processes, such as belief in personal efficacy in TB prevention (see CDC, 2016b). The lack of health insurance, difficulty paying for care, and lack of transportation may hinder access and

compliance to treatment for LTBI (Bagheri et al., 2017; Bisallah et al., 2018; Doosti et al., 2015; Getahun, 2015).

Implications

I found out that age in years and substance abuse history were related at statistically significant levels to LTBI treatment completion status. These findings could reinforce the need for healthcare providers to identify and treat the problem of substance abuse because the high prevalence and associated disease burden can result in higher healthcare costs over time, both for patients with substance abuse and for the healthcare system (Eric, 2017). This research may promote social change in Fulton County by providing actionable, testing and screening of PEH at increased risk of LTBI treatment noncompletion. Furthermore, with PEH being a focus of this research, findings may be used to inform homeless shelter administrators to know who may or may not be likely to complete treatment and encourage them to stay on treatment plans. Ensuring high rates of LTBI treatment completion can prevent future cases of active disease reducing healthcare costs and hospitalizations, improving individual quality of life, preventing transmission, and improving community health. As I and other researchers (Bradshaw et al., 2013; CDC, 2012a; Sallis & Owen, 2008 as cited in Blanz, Rimer, & Viswanath, 2008) have demonstrated, community, individual, and environment factors are important considerations in the development of successful public health interventions. This study has highlighted that age, and history of substance abuse is important interactive factors when assessing risk of LTBI treatment noncompletion. Lastly, this study adds to the incredibly limited body of knowledge surrounding LTBI treatment and has the potential

to lead to better targeted strategies for ensuring treatment access and completion among this vulnerable population.

Conclusion

My research study was intended to help public health practitioners and healthcare providers better understand how the demographic variables of age and substance abuse were related to treatment completion among PEH. However, exploring which substances or methods of substance abuse contributes to behavior that leads to LTBI treatment noncompletion could create partnership with substance abuse groups and programs. There are few researchers that illustrated treatment completion among PEH which means there is more work to be done in this area (Aliya et al., 2016; Hirsch-Moverman et al., 2015; Holland et al., 2019; Nwana et al., 2019; Onwubiko et al., 2019; Powell et al., 2017).

Future research efforts with larger samples and incorporating additional contextual risk factors could further elucidate the relationship between age, gender, shelter type, substance abuse, medication type and treatment completion among PEH in Fulton County. Health literacy could be measured at the time of being tested for LTBI and when results are given as well as after the timeframe of treatment (whether or not treatment was completed). As PEH have a high occurrence of conditions that are related to a higher risk for developing TB including substance abuse, HIV infection, and living in crowded situations this is high priority public health issue (CDC, 2016). This calls for a need to embrace patient centered disease treatment and management strategies, in TB prevention programs, embracing health information exchange effective and efficient TB

treatment interventions, taking time to understand the unique needs of individual patients and what will invariably elucidate crucial information for patient centered treatment and individualized management plans. Focusing on the patient and maintaining an open- two-way communication, will foster effective LTBI treatment completion and prevent active TB disease. Given the analysis described in this project, will encourage education and training in the behaviors of substance abuser and how healthcare providers could work with them to remain in treatment. And hopefully expands public health research interest in LTBI treatment completion outcomes not only among PEH but also within the overall population.

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Appendix A: Secondary Data Access.Approval Notice

Cooperation agreement information from agency removed from the appendix in order to mask the identity of the agency that provided the data. This information was provided to the Walden University Institutional Review Board as part of the IRB application approval process.