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The Impact of Immigration Variables on Tuberculosis Rates in South Carolina

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Abstract

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Abstract

After HIV/AIDS, tuberculosis (TB) is the deadliest single infectious agent worldwide; globally in 2013, 1.5 million people died of the disease. Although TB infection rates in the United States are low compared to that of other countries, TB still remains a threat to public health in the U.S., especially among immigrant populations. The main purpose of this study was to investigate the correlations between the independent variables of immigration status, years of residence, and race/ethnicity and the dependent variable of TB infection within South Carolina between 2006 and 2012. To examine these possible relationships, this quantitative study employed the ecological perspective theory and used secondary data from the Center for Disease Control's Online Tuberculosis Information System. The data were analyzed via linear regression and the findings indicated that the most statistically significant predictors of TB infection rates among the study population were immigration status and race/ethnicity. By analyzing the relationships between the study variables and population through relevant data analysis, this study provides public health professionals with additional resources to assist in designing effective TB interventions that have the highest likelihood of stemming the spread of TB. These factors also have the potential to illicit positive social change, not only within South Carolina but also on the national level by decreasing the incidence and prevalence of TB and allowing for the best use of resources to targeted populations most at risk for the disease.

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Chapter 1: Introduction to the Study

Historical Perspective on Tuberculosis

Tuberculosis (TB) is an infection in humans caused by the bacteria

Mycobacterium tuberculosis (Bynum, 2012, p. 1). *M. tuberculosis* is closely related to

Mycobacterium leprae, the bacteria responsible for leprosy, and has different

representations in different species (Bynum, 2012, p. 1). Archeological evidence

indicates that *M. tuberculosis* first appeared approximately 20,000 to 35,000 years ago

(Bynum, 2012, p. 1). However, the first evidence of the disease in humans dates to 5,800

BCE (Bynum, 2012, p. 1). TB has continued to plague humans throughout history, and

to date, few other infectious agents in the history of the world can match TB for the

misery and mortality it has inflicted on the human race (Sharma & Mohan, 2013). In the

19th century alone, recorded death tolls calculated that TB was responsible for 25.0% of

all deaths in Europe (Lawn & Zumla, 2011). Thankfully, with the advent of the industrial

revolution in the 20th century and subsequent increases in the quality of housing,

healthcare, nutrition and income, TB rates began to fall in the developed world (Lawn &

Zumla, 2011).

Even though 20th century medicine made tremendous advances in the care,

treatment, and eradication of a multitude of diseases and infectious agents, progress in the

treatment and prevention of TB did not fare as well (Peto et al., 2009). In fact, patients

who are currently infected with TB experience a 50.0% mortality rate, which is similar as

those who contracted the disease before the 20th century (Schneider, 2011, p. 115).

Globally, the number of new cases of TB is over 9 million and is higher than at any other time in recorded history (Lawn & Zumla, 2011). In the 21st century, nearly one-third of the worldwide population is infected with TB, and after HIV/AIDS, TB is the deadliest single infectious agent in worldwide (World Health Organization, 2012). Globally in 2013, approximately 9 million people contracted TB and 1.5 million died of the disease (World Health Organization, 2014a). Even though TB infection rates in the United States are low compared to other areas of the world, the disease continues to be a real threat to the country's population.

Epidemiology of Tuberculosis

Tuberculosis affects all populations although cases of TB are more prominent among those in the lowest socioeconomic status (SES), patients infected with HIV, and populations living in high TB burden settings such as prison inmates and psychiatric patients (Nardell & Churchyard, 2011). There are two types of TB: Pulmonary Tuberculosis (PTB) and Extrapulmonary Tuberculosis (EPTB). Pulmonary TB is the most common type of TB throughout the world, and the one on which this study will focus, occurring when the bacteria colonize in the lungs causing respiratory distress (World Health Organization, 2012). EPTB occurs when the bacteria colonizes outside the lungs (Peto et al., 2009). TB can manifest itself anywhere in the human body except for the hair and nails (Peto et al., 2009). In the United States, one-fifth of TB cases are EPTB (Peto et al., 2009).

Someone with PTB can fall into two diagnostic categories: latent TB (LTB) and active TB (ATB). A patient with LTB has the bacteria in his or her body but does not manifest symptoms and is not contagious to others. If patients with LTB are not treated, they have a 5.0% to 10.0% chance of developing ATB (Centers for Disease Control and Prevention, 2012). Antibiotics are an effective treatment for most strains of TB today, but the first use of the drug to fight TB was introduced in 1944 (Keshavjee & Farmer, 2012). Worldwide, approximately 2 billion people have LTB (Lawn & Zumla, 2011). Annually within the United States, approximately 200,000 to 300,000 patients are treated for LTB (Hirsch-Moverman, Bethel, Colson, Franks, & El-Sadr, 2010).

Despite the dire state of TB incidence and prevalence worldwide, cases of TB in the United States are the lowest they have been in several decades, and infection rates of TB have declined 65.2% over the last 17 years (Holden & Trachtman, 2012). Of the population of the United States in 2010, only 3.2% was estimated to be infected with LTBI and only 11,000 cases of ATB manifest each year (Gordin & Masur, 2012). With these improved numbers, the consensus would be that TB is a decreasing threat to the population of the United States. However, without vigilance, awareness, and examination of factors, such as immigration and related factors and their impact on TB infection rates, the cases of TB among the general population may begin to rise again and the country could be faced with a new TB public health crisis.

Tuberculosis Diagnosis and Treatment Resources

The internationally recognized and most effective strategy for combating the spread and incidence of TB is known as the Directly Observed Treatment Short Course (DOTS; World Health Organization, 2014b). Since its inception in the 1990s, DOTS has become the internationally recommended strategy to combat TB and has been adopted by 187 of the 211 countries on the planet, which represents 89% of the global population (Mittal & Gupta, 2011). DOTS consists of a five prong strategy that includes political commitments from countries throughout the world to fight the spread of TB, case detection using sputum microscopy, standard short course chemotherapy, adequate and regular anti-TB drug therapy supplies, and a standardized reporting and recording system for TB cases (World Health Organization, 2014b).

Even though therapies for TB under DOTS has been shown to be very effective in fighting the disease worldwide, a major barrier to TB control remains the lack of adherence by individual patients to testing, treatment, and therapies (Mittal & Gupta, 2011). Free TB testing, treatment, and other resources are available for all residents of the United States, including immigrants. The Centers for Disease Control and Prevention (CDC) has established a TB Control Office in all 50 states, and these treatment centers provide testing, drug therapies, interventions, and resources for TB patients (CDC, 2014). Even though such resources are available, one of the real challenges related to TB for public health workers in the United States is overcoming barriers related to testing and treatment, especially for at-risk populations such as immigrants from high burden TB

countries. In Chapter 2, these barriers and ways to overcome them will be addressed via a literature review of current studies and methodologies.

Problem Statement

In 2010, there were 11,182 cases of TB and 547 deaths from the disease in the United States (Gordin & Masur, 2012). Of those infected with TB in the United States every year, over half are immigrants (Gordin & Masur, 2012). Between 2001 and 2008, of the 114,323 new TB cases in the United States, 54.6% (62,364) were diagnosed among foreign-born residents (Liu et al., 2012). Every year, approximately 500,000 immigrants and refugees are granted residence in the United States along with 163 million visitors from outside countries and an untold number of aliens who enter the country illegally (Liu et al., 2012). Of these numbers, only immigrants and refugees who enter into the United States through proper channels are screened for TB (Liu et al., 2012). Among the immigrants who are tested for TB, ATB is diagnosed in 7.0% of that population (Liu et al., 2012). Among residents and citizens in the United States who are tested for TB, 18.7% were foreign-born (Horsburgh & Rubin, 2011). Furthermore, data indicate that immigrants who have been in the United States less than 2 years have higher incidence rates of TB than immigrants who have been in the country longer than 2 years (Willis et al., 2012).

Over time, the number of TB cases among the immigrant population of the United States has risen substantially. In 1986, less than 25.0% of the cases of TB within the United States were foreign-born; in 2010, 60.0% of the cases of TB within the

country were among immigrants (Olson et al., 2012). Although TB rates have declined among the general population of the United States over the last 2 decades, the decline was more significant among those born in the United States (Olson et al., 2012). In fact, the TB infection rate among foreign-born residents rose from 3.8% in 1990 to 11.3% in 2010 (Olson et al., 2012). These significant rates point to the fact that certain portions of the immigrant population pose a significant health threat in terms of exposing the general population of the United States to TB.

Purpose of the Study

The main purpose of this quantitative study is to investigate correlations between TB infection rates among immigrants in South Carolina and the potential impact these rates had on the general population of South Carolina between 2006 and 2012. In order to accomplish this goal, data regarding immigration status, years of residence, and race/ethnicity among the population of South Carolina were examined. Although research has been conducted regarding the risk associated with these variables and TB infection rates in the United States over the last 30 years, very few studies, if any, have examined this topic in relation to the state of South Carolina. By studying these relationships, public health professionals at the state and federal levels will have the ability to design interventions that are aimed at addressing the variables that have the highest correlation.

Research Question and Hypothesis

RQ1:   What is the relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012?

$H1_o$:   There is no relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012.

$H1_A$:   There is a relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012.

RQ2:   What is the relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012?

$H2_o$:   There is no relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012.

$H2_A$:   There is a relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012.

RQ3:   What is the relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012?

$H3_o$:   There is no relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

$H3_A$:   There is a relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

Theoretical Framework

The theory that this research employed was the ecological perspective. The ecological perspective theory has been acknowledged as being helpful in assisting researchers in determining the areas on which the greatest amount of focus should be concentrated and prioritizing issues that need to be addressed (National Cancer Institute, 2005). Since my research will also focus on multiple factors on multiple levels, this theory is a good fit for this dissertation.

The ecological perspective theory was introduced by Carel Germain in 1973 in an attempt to supplement systems theory and offer alternative hypotheses regarding the interactions of factors on multiple levels (Johnson & Rhodes, 2009, p. 5). Germain, a prominent social worker in the 20th century, was recognized globally for her exhaustive research regarding the impact of multiple levels of society on human behavior (Johnson & Rhodes, 2009, p. 5). Her theory and concepts, although developed for social work, are also relevant and applicable to other fields, including public health, as they offer alternative hypotheses and views for causation and correlation (Johnson & Rhodes, 2009, p. 162). Concepts developed by Germain that have been adopted by multiple disciplines include adaption, goodness-of-fit, niche, and habitat (Johnson & Rhodes, 2009, p. 162).

The ecological perspective focuses on the interaction of factors in all aspects of a health problem on three specific levels: intrapersonal, interpersonal, and community (National Cancer Institute, 2005). Intrapersonal factors encompass individual characteristics that determine behavior, including a person's knowledge, attitudes,

beliefs, and traits specific to his or her personality type (National Cancer Institute, 2005).

Interpersonal factors include family, friends, peers, and colleagues and associates who

provide an individual with his or her social and cultural identity, offer support in all

aspects of his or her life, and define his or her role in society (National Cancer Institute,

2005). The community level is broken down into three subcategories: institutional,

community, and public policy. Institutional factors include rules, policies, regulations,

and informal structures individuals encounter in their part of their life where they operate

on a professional or nonintimate level such as school and employment (National Cancer

Institute, 2005). The influences present in the community category encompass social

networks on all levels (individual, group, and organizational; National Cancer Institute,

2005). Finally, factors that come into play in the public policy category are laws,

regulations, and public policies that mandate, support, and regulate attitudes, actions, and

behaviors aimed at preventing injury and disease to promote an overall healthy lifestyle

(National Cancer Institute, 2005).

For the purposes of this study, the ecological perspective theory is the best fit as

connections between variables were explored on each of the three specific levels defined

in the theory. On the intrapersonal level, correlations were explored between TB

infection rates and race/ethnicity within the population of South Carolina between 2006

and 2012. Interpersonal factors are relevant to the correlation between immigrant status

and years of residence in South Carolina and TB rates as the social networks populations

find themselves in and who they associate with could potentially put them at risk for contracting TB.

Definition of Terms

Immigrants: The population of the United States (who are here either legally or illegally) who were not born in the U.S or U.S. territories.

Population of South Carolina between 2006 and 2012: Those individuals (male and female) of all ages who were either residents or resided in the state for 6 months or longer between the specified study period and who were documented in public data records at the county, state, and federal levels.

Tuberculosis (TB): Unless otherwise identified, for the purpose of the study, when the term TB is used, it is referring to Pulmonary Tuberculosis, both ATB and LTBI.

Nature of Study

This quantitative study was based on a retrospective research design and used multiple linear regression. A quantitative study is consistent with the use of secondary data where correlations based on hard data are being evaluated. A retrospective study is best suited to analyzing data collected previously and also for comparing data from various sets that can be linked via a common variable or variables, all of which apply to this study (Chumney & Simpson, 2006).

Assumptions

This study is nonexperimental and analyzed coded archived secondary data from sources that have already obtained IRB approval. All participants have been tested for

TB by a public health service. Therefore, it was assumed that the data used had minimal

bias in order to ensure that the results from each group were sound and comparable.

Limitations and Strengths

Being a retrospective study, random selection of participants was not used.

Nonrandomization would decrease the generalizations of the findings to other

populations. Without randomization, the results of the study might only reflect the

specified populations used in the study and not accurately reflect the general population.

Furthermore, I could not control a number of confounding variables that could potentially

have an impact on TB infection rates. Such variables would include willingness,

availability, and/or the requirement of a wide cross-section of the state's population to be

tested for TB, comprehensive testing of residents, and false-negative TB tests among the

study population. Due to these limitations, more research should be conducted on this

subject by future researchers.

Regardless, the strengths of the study far outweigh the limitations. Such strengths

include the large cross-section of data analyzed among the general population of South

Carolina, validity and rigor of secondary data employed, and the type of analysis used to

ensure the statistical strength of the results. Another significant strength of this study is

its ability to fill a gap in the research regarding TB infection rates and its contributing

factors in the state of South Carolina.

Significance of the Study

By conducting research into the correlations between immigration status, years of

residence, and race/ethnicity and TB rates in South Carolina between 2006 and 2012, the

resulting data and conclusions have the potential to enable epidemiologists at the county,

state, and federal levels to develop intervention and prevention methods that are aimed at

inhibiting the spread of TB not only among the study population but also within the

overall population at the state and nationwide levels. Such results could inspire positive

social change by decreasing TB infection rates, which has the potential to have a positive

impact on public health, economies, and societies in general.

Ethical Concerns

There are limited ethical concerns to study due to the reliability and validity of the

secondary data being used. The possibility that patients' privacy and rights will be

violated is minute because no personally identifying information was included in the

extracted data.   As required, IRB approval was obtained before accessing data, and all

policies and regulations of the institutions from which the data were obtained was strictly

followed.

Summary and Transition

As has been stated in this chapter, TB is still a very real threat to all populations.

Furthermore, further research needs to be conducted regarding the association between

TB and immigration status, years of residence, and race/ethnicity in order to determine

which variables in specific contribute to the spread of TB and how those risks can be

avoided.   By analyzing these correlations within South Carolina, public health officials on all levels may be given valuable tools to help them in the fight against TB and limiting the disease's threat to all populations. The literature review to follow will highlight research that has already been conducted into this topic over the last 30 years and also expose gaps in the literature that this research hopes to fill.

Chapter 2: Literature Review

Immigration in South Carolina

One of the reasons for higher TB infection rates among the immigrant population in the United States over the last few decades may be attributed to the fact that many among this population originate from low SES countries where TB rates are often 60 times higher than TB rates in the United States (Olson et al., 2012). This is a particular problem in South Carolina as the agricultural industry within the state often relies on migrant workers from Mexico and other Central and South American countries, many of which are categorized as high burden TB countries (Turner, 2014). One of the obstacles associated with diagnosing TB within the immigrant population in the United States is that a large percentage of this population are not tested for TB or do not seek treatment for symptoms of the disease due to barriers such as social stigmas, misinformation, and mistrust of the medical system (Liu et al., 2012). By reviewing previous studies that examined the historical perspective of TB within the United States, ways of overcoming barriers to testing and treatment and the correlations between immigration status, years of residence, and race/ethnicity on the nationwide or state level, information may be gained that will assist in the identification of such correlations among those populations within South Carolina and add to the scholarship of this dissertation.

Organization, Strategies and Justification

Organization of the Review

      The goal of this chapter is to offer a thorough analysis of the literature regarding the correlations between the aforementioned variables and TB infection rates among the population of South Carolina between 2006 and 2012. In the first section, I discuss published literature that has also used the ecological perspective theory in examining TB's impact on specific populations. The second section shows a historical perspective regarding TB infection rates on the national level and the study variables over the last 30 years. The third section addresses barriers to TB diagnosis and treatment among immigrants and ways to overcome these obstacles. In the fourth section, I evaluate the recent associations between immigration status, years of residence, and race/ethnicity and how these variables may impact TB infection rates in South Carolina.   The literature and methodology section addresses a synopsis of these studies and how they may relate to this research. Finally, I conclude the chapter with a summary that highlights findings and a transition to the next chapter.

Strategies for Searching for Literature

      This literature review was accomplished through searching online databases. These databases included Medline, CINAHL Plus, PubMed, Nursing and Allied Health Source, Health and Medical Complete, Science Direct, Eric, and Google Scholar. The databases were explored using the following search terms either individually or in combination to locate appropriate articles for review: *tuberculosis, South Carolina,*

southern states, immigration, Georgia, North Carolina, Alabama, Mississippi, Tennessee, United States, race, ethnicity, years of residence, migrant workers, and/or *foreign-born status*. The research and information gained from these studies were evaluated, annotated, summarized, and catalogued for the purpose of being used in this review.

Justification of the Study

When conducting a preliminary review of the research in preparation for a topic selection, it was observed that there were significant gaps in the research regarding TB infection in South Carolina in respect to the aforementioned variables. Very little quantitative research was discovered that explored the relationship between the proposed variables of this study and TB infection rates in the population of South Carolina between 2006 and 2012. This significant gap raised several concerns. Therefore, in order to facilitate positive social change, raise awareness of the variables that contribute to TB infection rates, and decrease the incidence and prevalence of the disease populations, this study was initiated

Theoretical Framework

Traditional theories of disease investigation and control involve the examination of the epidemiological triad of agent, host, and environment (O'Connor, Haydon, & Kao, 2012). However, by employing the ecological perspective theory, researchers are afforded tools to examine other factors outside of the traditional triad in order to develop effective disease intervention and control strategies (O'Connor et al., 2012). In fact,

Tabachnick (2010) coined the term "episystem of disease" to convey the whole systems approach offered via the utilization of the ecological perspective (Tabachnick, 2010).

Although Tabachnick (2010), in his research, was primarily concerned with the impact of climate change on disease, his assertions regarding the effect of an organism's surroundings on its biological makeup applies to all environments and is applicable to this research in multiple ways but primarily when it comes to analyzing the effect of geographical area on TB infection rates. According to O'Connor et al. (2012), although some diseases can be controlled by addressing just one or two factors, many others, including TB, need to be examined on a holistic level, and every contributing disease risk factor must be evaluated and studied in order to provide an effective control and eradication campaign (O'Connor et al., 2012).

As previously stated, many societal factors have an impact on risk factors for TB. In their article, Ploubidis et al. (2012) employed an ecological perspective to evaluate the impact of multiple levels of SES (access to health care, migration rate, gross domestic product) on TB rates of countries who are members of the WHO European Region (Ploubidis et al., 2012). The authors were able to identify a correlation between low SES and higher TB rates within the countries examined and their findings have a direct correlation with this dissertation (Ploubidis et al., 2012). By employing ecological perspective theory in their analysis of TB rates in the chosen European countries, the authors were afforded the opportunity of examining the risk factors for the disease

beyond the historically prevalent ones and allowed for more homogeneous thinking when it comes to future TB studies, including this one.

Historical Perspective

The correlation between immigration status, years of residence, and race/ethnicity on TB infection rates within the United States has been the subject of several studies performed over the previous 3 decades. However, very few studies have been conducted on these correlations in the 21st century, specifically in regards to South Carolina. One example of a past study that evaluated this study's variables and TB infection rates was conducted by Farer, Lowell, and Meador (1978). The study used a retrospective study, and the authors found a correlation between race/ethnicity and TB infection rates within the United States during the early to mid-1970s (Farer et al., 1978). In the article by Rieder, Snider, and Cauthen (1990), the authors also used a retrospective cohort study to examine extrapulmonary and pulmonary TB infection rates among specific racial and ethnic populations in the United States in 1986 (Rieder et al., 1990). The researchers found that during the study year, 63.0% of all pulmonary cases and 71.2% of extrapulmonary cases of TB occurred among racial/ethnic minorities and immigrants (Rieder et al., 1990). These results are further supported by the study conducted by Cantwell, Snider, Cauthen, and Onorato (1994) in which the authors found that 60.0% of the increases in rates of TB in the United States from 1986 through 1992 occurred among immigrants with the largest percentage among Hispanics (Cantwell et al., 1994).

In the study conducted by McKenna, McCray, and Onorato (1995), the authors employed a linear interpolation of a 5.0% sample of all households in the United States between 1980 and 1990 (McKenna et al., 1995). The data used in the study were obtained from the United States census and the CDC and analyzed country of origin to evaluate correlations between race/ethnicity and TB infection rates. The findings of the study indicated that between 1986 and 1993, TB cases among immigrants in the United States increased from 21.6% to 29.6% (McKenna et al., 1995). The authors broke these data down further and discovered that the majority of the TB cases, 43.9%, were among people who originated from Latin America (McKenna et al., 1995). Furthermore, the study indicated that the TB infection rate among immigrants was almost quadruple to the TB infection rate among native-born residents of the United States (McKenna et al., 1995).

A study that showed a historical correlation between immigration, years of residence, and race/ethnicity and TB infection rates in the United States was conducted by Talbot, Moore, McCray, and Binkin (2000). The data analyzed in the study indicated that between 1993 and 1998, the TB case rate among immigrants was 32.9% compared to 5.8% among the native-born population of the United States (Talbot et al., 2000). Furthermore, the results of the study indicated that 51.5% of the cases of TB were among immigrants who had been in the United States for 5 years or less (Talbot et al., 2000). In addition, approximately 2/3 of the TB cases were among immigrants who originated from Mexico and other high burden TB countries (Talbot et al., 2000). Even though the

studies highlighted in this section were conducted decades prior to this study, they are

relevant and important to this dissertation in that they help to establish patterns and

historical perspectives of TB infection rates and correlations between immigration status,

years of residence, and race/ethnicity.

Barriers to Tuberculosis Diagnosis and Treatment Among Immigrants

Screening immigrants for a variety of diseases and ailments is a practice that the

United States has been employing on various degrees and levels since the 18th century

(Dara, Gushulak, Posey, Zellweger, & Migliori, 2013). However, prior to the 20th

century, health screenings for immigrants coming into the country were often

rudimentary at best and sometimes skipped altogether depending on the point of entry

and resources available (Dara et al., 2013). With the advent of the industrial revolution at

the beginning of the 1900s and the large influx of immigrants into the United States that

it spawned, the government began to place public health workers at immigration points

across the country and established large intake facilities such as Ellis and Angel Islands

(Dara et al., 2013). Today, the main agency responsible for collecting and cataloging

data regarding the cases, infection rate, and spread of TB in the United States is the

United States National Tuberculosis Surveillance System (NTSS; Pratt, Winston,

Kammerer, & Armstrong, 2011).

Many who are at the highest risk for contracting TB or who actually have the

disease do not wish to be tested or seek treatment. This is especially true among

immigrant populations who often fear deportation or do not have the resources to seek

medical testing and care (Walter et al., 2014). Since 2012, TB cases among immigrants have risen to 63.0% of the total cases of TB in the United States (Walter et al., 2014). Since TB infection rates are more than twice as high among immigrants than among the general population of the United States, it is important to identify the main reasons why immigrants are resistant to TB testing and treatment.

The evolution of TB screenings among immigrants and the effectiveness of these techniques is the focus of the historical retrospective study by Dara et al. (2013). As the researchers discussed, early screenings for TB among immigrants was not so much focused on preventing the disease from entering the country and spreading to permanent residents but was instead dedicated to stopping infected immigrants from entering the country who could potentially become a burden on the public health system and who could not work and pay their way in society (Dara et al., 2013). However, with the wide use of antibiotics to treat TB infections in the mid-20th century, the main purpose of TB screenings among immigrants evolved into treating those infected before the disease could spread to the general population (Dara et al., 2013). As in the article by Wieland et al. (2012), the authors also explored the various reasons behind immigrants not wanting testing or treatment for TB and traced the evolution and consistency of these reasons, including social stigmas, misinformation about the symptoms and treatments for the disease, and their extreme desire to enter the United States in order to build a better life for themselves and their families (Dara et al., 2013).

In the article by Wieland et al. (2012), the authors explored the disparity between TB infection rates among immigrants as compared to the overall population of the United States (Wieland et al., 2012). As the authors pointed out, the CDC recommends testing immigrants from high TB countries for the disease upon their entry in the United States. However, due to limited funding, staffing, resources, and the lack of knowledge or participation by the immigrants themselves in testing and follow up care, this practice is not often followed (Wieland et al., 2012). The authors analyzed the behaviors and social organization of a group of immigrants who attended an adult education center in Rochester, New York. By employing the principles of the health belief model (HBM), the authors conducted a qualitative study that used written and oral questionnaires in order to identify why the study participants were hesitant to be screened for TB, and if diagnosed with the disease, why so few sought treatment (Wieland et al., 2012). Of the 54 participants in the study, many indicated that they did not seek testing or treatment for TB because they had limited knowledge about the dangers and/or risks associated with the disease. Furthermore, several expressed the misconception that TB was not present in the United States and therefore was not something about which they needed to be worried (Wieland et al., 2012). Still other participants were worried about the social stigmas associated with TB and also were under the misconception that TB was a fatal disease. Therefore, they believed they were better off not knowing if they were infected (Wieland et al., 2012). For those participants who were willing to be tested, they often resisted being treated for TB due to the illusion that the treatment for the disease was either

inaccessible, too expensive, or they had a general suspicion and mistrust of doctors and

medication (Wieland et al., 2012). The authors suggested several ways to overcome the

aforementioned barriers to TB education and treatment among immigrants, including

extensive instruction about the causes, symptoms, treatment options, and resources

available for TB patients. Through such education and implementation of similar

methods among other immigrant populations in the United States, the stigmas and

misconceptions surrounding TB could be overcome and positive outcomes could be

reached not only for immigrant populations but for the overall population of the United

States as well (Wieland et al., 2012).

Study Variables

Immigration Status

Cain et al., (2012) conducted a sensitivity analysis of Tennessee's TB detection

program, focusing specifically on the higher burden of TB among immigrants in the state

(Cain et al., 2012). Even though reported cases of TB have decreased by 58.0% from

1992 to 2010, the majority of this reduction (75.0%) occurred among the U.S. born

population (Cain et al., 2012). In fact, the current rate of TB infection among the

immigrant population within the United States is 11 times higher than rates among the

population born within the United States (Cain et al., 2012). In order to explore the

effectiveness of Tennessee's TB intervention program, the researchers evaluated data

collected from 168,517 TB testing participants in the program from March 2002 to

December 2007 (Cain et al., 2012). Although only 17.0% of the TB tests conducted

during the study period were given to foreign-born residents of Tennessee, this population had a disproportionally higher incident rate of TB (33.0%) than did the U.S. born population who participated in the study (5.0%; Cain et al., 2012). One of the flaws in the study, and that was acknowledged by the authors, was the acknowledgement that it is often difficult to track the TB infection status of many immigrants as they frequently do not seek medical care due to their illegal status and/or lack of financial resources and insurance (Cain et al., 2012). However, the authors did not offer suggestions as to how to address this gap. The Cain et al. (2012) study is relevant to this dissertation in that it explores the TB infection status among immigrants in a state that is similar to South Carolina in population, location, and SES.

Ricks et al. (2011) evaluated TB reactivation rates among immigrants in the United States between 2005 and 2009 (Ricks et al., 2011). The authors conducted a retrospective cross sectional study of 36,860 TB cases that were identified from the United States National TB Genotyping Service (Ricks et al., 2011). The goal of the study was to compare TB reactivation rates among native and foreign born persons living in the United States. The authors' findings indicated that the foreign born study population who had TB contracted their current infection from reactivation; i.e. they had contracted the disease outside of the United States (Ricks et al., 2011). From these findings, the authors concluded that it would be a valuable use of resources to screen immigrants coming into the United States for TB to minimize reactivation if they did test positive for the disease thus reducing the risk of spreading the contagion to the population (Ricks et al., 2011).

One of the findings of the study was that among the study population, immigrants from Mexico accounted for 23.7% of TB cases in the United States during the last half of the first decade of the 21st century (Ricks et al., 2011). These findings are relevant to this dissertation as a significant percentage of the immigrant population in South Carolina are from Mexico or other Central and South American countries, that are classified as high burden TB countries. Therefore, the results from this study will help to establish a nationwide correlation between immigration status and TB rates that can be extrapolated to the study population within South Carolina.

Olson et al. (2012) used a Poisson regression model to explore correlations between SES and TB rates among a cross section of citizens in the United States through data obtained through the ZIP Code Tabulation Area (ZCTA) collected in the 2000 U.S. census (Olson et al., 2012). The results of the analysis indicated that of the 170,590 verified cases of TB in the United States from 1996 to 2005, over half of the study's populations, 52.2%, were immigrants (Olson et al., 2012). The authors acknowledged that the limitations of the study included low reporting of TB status among immigrants and this limitation could have skewed the findings. As such, the authors discussed the fact that the rates of TB among immigrants could actually be higher than estimated by the study due to the high prevalence of TB among the countries where the majority of the study population immigrated from (Olson et al., 2012). The data and analysis provided in the article are valuable to this dissertation in that it can be used to make inferences and comparisons to TB infection rates among immigrants in South Carolina.

In order to investigate the impact of testing and follow-up among laborers from a low-SES, Person et al., (2010) conducted a retrospective, cross-sectional study of employees who were exposed to TB in the workplace (Person et al., 2010). The researcher's screened 326 employees for TB and HIV at their work-place in Wake County, North Carolina (Person et al., 2010). Of the study population, 22.0% were immigrants/foreign born and 4.9% were Hispanic (Person et al., 2010). Among the overall study population, 20.3% tested positive for TB (Person et al., 2010). Of the percentage of the population which were immigrants, 53.7% tested positive for TB; among the native-born population, 11.7% tested positive for TB (Person et al., 2010). One of the main gaps in the article was the fact that many within the study population who tested positive for TB did not return for follow-up care and secondary testing to confirm the initial diagnoses (Person et al., 2010). Another gap in the study that was acknowledged by the authors was the lack of information regarding whether or not the immigrant population had undergone BCG vaccination in their home country for TB (Person et al., 2010). Along with Cain et al. (2012), Liu et al. (2012), Ricks et al. (2011) and Olson et al. (2012), the results of this study further support the fact that there is a high correlation between immigrants from specific TB high burden countries and TB infection rates that supports the main hypothesis of this dissertation.

Years of Residence

Like many infectious diseases such as influenza and the common cold, TB often follows seasonal trends with higher incidence rates in the fall and winter months than in

the spring and summer (Willis et al., 2012). This is precisely the focus of the article by

Willis et al. (2012) in which the authors analyzed the seasonal trends of TB in the United

States (Willis et al., 2012). In order to support their hypothesis, the authors conducted a

time series decomposition analysis of TB cases that were reported to the CDC between

1993 and 2008 (Willis, et al., 2012). The study population included a cohort of 243,432

patients with laboratory confirmed TB (Willis et al., 2012). The majority of TB cases

(28.6%) during the time period covered by the study were found to be in the

southernmost part of the United States (including South Carolina) (Willis et al., 2012).

The authors also broke the population down into race and years of residence in the United

States. Of the 4 ethnicities examined in the article (white, African American, Hispanic

and Asian), African Americans and Hispanics had the highest percentage of TB infection

rates (29.2% and 26.9% respectively) of the study population (Willis et al., 2012). In

regards to the impact of immigration status on TB infection, the results of the study

indicated that the highest rates (26.1%) were among immigrants with less than one year

of residence within the United States (Willis et al., 2012). Not only did the authors offer

statistics regarding the impact of immigration on TB infection rates in the United States,

they also provides insights into the correlation between years of residence and TB

infection rates that is one of the hypotheses of this dissertation.

In order to assess the impact of length of residence among immigrants on TB

infection rates in the United States between 2001 and 2008, Liu et al., (2012) conducted a

retrospective cross-sectional analysis of data obtained from the United States Department

of Homeland Security, CDC, and WHO (Liu et al., 2012). According to the authors,

among the 163.5 million immigrants admitted to the United States every year, only

500,000 are tested for TB and this lack of testing among the majority population of

immigrants contributes to the overall TB infection rate in the United States (Liu et al.,

2012). The authors examined TB rates among immigrants who had been in the United

States less than one year and who were identified via data obtained from the United

States Department of Homeland Security (USDHS), CDC, and WHO (Liu et al., 2012).

The authors broke the immigrant population down into specific categories: migrant

workers, refugees, immigrants seeking permanent residence, students, tourists, and

diplomats (Liu et al., 2012). The authors found that immigrants seeking permanent

residence and refugees from high-burden TB countries who had resided in the United

States for less than one year accounted for the highest percentage (41.6%) of TB cases

among the study population (Liu et al., 2012). The authors acknowledged that the main

limitation of the study was the lack of reporting and screening for TB among all

immigrants and affirmed that this posed a very real obstacle for solid conclusions to be

drawn regarding the overall impact of immigration status and years of residence in the

United States on the overall TB rates within the country (Liu et al., 2012). However, the

findings of the study supported the hypothesis proposed by Willis et al. (2012) that

immigrants from high TB burden countries with less than 1 year of residence in the

United States pose the greatest risk of TB exposure to the overall population of the

United States (Willis et al., 2012). The conclusions of both of these studies will offer

comparisons of TB rates among immigrants in South Carolina when evaluating the

correlation between years of residence on TB infection rates within the state.

Race/Ethnicity

As previously indicated, certain countries have a higher TB burden than others

and people from these countries who are immigrating into the United States are at greater

risk for spreading TB to the general population. In their article, Walter et al., (2014),

conducted a quantitative cohort study that examined Filipino immigrants who entered the

United States through California between 2001 and 2002 (Walter et al., 2014). As

indicated by the authors, the Philippines is a high burden TB country and immigrants

from this nation represent a significant percentage of the immigrants who come into the

United States every year (Walter et al., 2014). More specifically, over 60% of Filipinos

are estimated to have LTBI and represent one of the highest TB rates of any

race/ethnicity in the United States (Walter et al., 2014). Furthermore, unlike other

ethnicities that immigrate into the United States, TB infection rates among Filipino

immigrants do not decrease over years of residence in the United States (Walter et al.,

2014). The authors concluded that in order to address the high burden of TB among

Filipino immigrants to the United States, local, state, and federal health departments

should be more vigilant in diagnosing and following up with this particular population to

not only provide them with care and treatment but also to limit the spread of TB to the

general population (Walter et al., 2014).

In their article, Barrington, Hilfinger-Messias and Weber (2012) conducted a qualitative community-based research study in order to examine the history of the Latino population in South Carolina and the dynamics created by the increase of this community in the 21st century (Barrington, Hilfinger-Messias, & Weber, 2012). The authors pointed out that prior to the 1990s; the Latino population in South Carolina was less than 0.6% consisting mainly of those with Puerto Rican, Cuban, and Mexican heritage (Barrington, Hilfinger-Messias, & Weber, 2012). However, due to increased agricultural and other low-wage jobs in the state, by 2004 the Latino population within South Carolina had grown to 7.6% which was ranked as the fourth fastest growing Latino population throughout the United States (Barrington, Hilfinger-Messias, & Weber, 2012). This rise in the Latino population in South Carolina would seem to correlate with the increases in TB infection rates within the state during the same time period. The authors gathered qualitative data from 69 participants via the Women's Well Being Initiative's Latina Task Force on several perceived variables including race/ethnicity, SES, and access to community resources (Barrington, Hilfinger-Messias, & Weber, 2012). The authors acknowledged that some of the limitations of the study were the biases associated with self-reporting of data and low participation in comparison to the overall Latino population of the community. Although this study did not address TB specifically, the research is valuable to this dissertation in that it demonstrates an increase in the population of South Carolina among specific race/ethnicities who originate from countries that have a high TB burden.

Literature and Methodology

Ricks et al., (2011), Person et al., (2010), and Liu et al., (2012) conducted retrospective cross-sectional studies to evaluate the correlation between immigration status and/or years of residence in the United States and TB infection rates within the study populations. Since this dissertation also employed a retrospective study design, these articles provided valuable guidelines and analysis that were relevant to this study. In order to analyze the impact of immigration status on TB rates on a state level, Cain et al., (2012) conducted a sensitivity analysis in order to determine the effectiveness of Tennessee's TB detection program and identify gaps to be addressed in future program reviews and evaluations. Wilson et al. (2012) conducted a time series decomposition analysis to determine the seasonal rates of TB and the areas of the United States where these rates were the highest and concluded that immigrants who had resided in the United States for less than a year had a significant impact on TB infection rates in southern states, including South Carolina. The study that focused specifically on the state of South Carolina was the one conducted by Barrington, Hilfinger-Messias, and Weber (2012). The authors offered relevant and recent statistics that indicated that over the last 2 decades, the percentage of immigrants coming into South Carolina from high burden TB countries has increased significantly. Even though this article di not deal specifically with TB infection rates, it offered valuable data regarding race/ethnicity within South Carolina and how these groups interact with each other that could have a correlation with a rise in TB infection rates among this population.

The articles highlighted in this chapter not only offered insight into the impact of the variables studied in this dissertation on TB infection rates in South Carolina, they also identified exposure risks for the general population; all of which have a direct correlation with the purpose of this dissertation. Furthermore, all the articles, save one, analyzed in this literature review used coded, secondary archived data from databases; this was the same type of data that was used in this dissertation. This fact reinforced the reliability and validity of the data and provided a strong foundation for this dissertation.

Summary and Transition

Given the information and statistics presented from previous studies and the fact that TB is still a very dangerous and relevant disease among all areas of the populations, it is imperative that specific risk factors for TB be examined and correlations be studied in order to prevent future outbreaks on all levels. From the aforementioned studies that examined the impact of immigration, years of residence within the United States and race/ethnicity, correlations were drawn that support the efficacy and scholarship of conducting new research into these variables as they pertain to the population of South Carolina. Although the findings of the studies in this literature review are not surprising and are in alignment with expectations, they do present information that provided a strong basis for the foundation of this study.

However, for all of the support that the aforementioned studies added to this inquiry, they also identified gaps in the current research that this dissertation hoped to address. In the article, Cain et al. (2012), the authors offered no definitive explanation as

to why the design they used in their study was the best choice and/or why it was chosen (Cain et al., 2012). In comparison, as previously stated, this dissertation employed a qualitative retrospective research design that was best suited for comparing data from various sets that were linked via a common variable or variables, all of which were applicable to this study (Chumney & Simpson, 2006). Barrington, Hilfinger-Messias, and Weber (2012), used data from the Women's Well Being Initiative's Latina Task Force to draw their conclusions regarding the effect on certain variables on health effects (Barrington, Hilfinger-Messias, & Weber, 2012). However, the authors did not indicate whether or not they had used any other data at the local, state or federal level in order to support their hypotheses and justify their methodology. The absence of such relevant data, although perfectly warranted, if left unexplained, could call their findings into question. Since this dissertation incorporated valid and reliable secondary data gathered at the state level that is comparable to data from other states and territories, the findings of this study will be statistically sound and thorough thus further address gaps in the existing literature.

Ricks et al. (2011), established a significant link between immigrants from Mexico and TB infection rates in the United States between 2005 and 2009 based on the study variables of age, time of residence in the United States and country of origin (Ricks et al., 2011). As mentioned, the study is relevant to this dissertation in that it provided a foundation for study variables but since the study's population size included all cases of TB positive immigrants arriving into the United States from 25 high-burden TB countries

between January 2005 to December 2009 ($N = 51,015$), such a large sample size could very well have skewed the results and call the study's findings into question (Ricks et al., 2011).   Since this dissertation used a much smaller sample size, room for error, and skewing of results were significantly smaller and less likely thus allowing for more statistically sound results.

An issue with sample size was also present in the article by Person et al (2010). The study screened 326 employees for TB and HIV at their work-place in Wake County, North Carolina and concluded through the results of the study that TB was more prevalent among immigrants than native born workers (Person et al., 2010). However, it is unclear as to whether or not the sample size of the study is sufficient to make assumptions about the TB infection rates among immigrants throughout the entire state. As this dissertation incorporated all data pertaining to TB positive individuals within South Carolina, immigrant or otherwise, between 2006 and 2012, it is assumed that the results will be statistically sound and applicable to the entire state and beyond.

Additionally, the studies conducted by Cain et al. (2012), Ricks et al. (2011), Olson et al. (2012), Person et al. (2010), and Walter et al. (2014), examined statistics that predated the data that were analyzed in this study. Therefore, this dissertation addressed a gap in the current literature in regards to updating the research in reference to the infection rate of TB among immigrants and how those rates impact the overall population of South Carolina that may, in turn, may be extrapolated to larger populations nationwide.

As detailed in this chapter, through the examination of existing literature, TB among immigrants remains a very real risk not only among that population but also among the native-born population of the United States as well. It has also been established through the literature review detailed in this chapter that it is imperative that public health officials understand the risks associated with the variables of immigration status, years of residence, race/ethnicity and TB infection rates in order to combat the disease in all populations. In Chapter 4, the study's research design, rationale and methodology will be detailed based on the models and gaps highlighted in this chapter.

Chapter 3: Research Method

Chapter Overview

The purpose of this study is to explore the correlation between specific demographic variables and TB infection rates among the population of South Carolina between 2006 and 2012. The focus of this chapter is to highlight the method by which the data were collected and analyzed. In the first section, I will describe how the research was designed and what approach and rationale was used. The next section provides details concerning the methodology of the study and will be broken down into population, sampling and procedures, information on obtaining archived data, instrumentation, the data analysis plan, and ethical concerns. The chapter will then conclude with a summary of the information presented.

Research Design and Rationale

This quantitative study was of a nonexperimental nature and used coded, tabulated secondary archived data that were collected and maintained by the CDC. Secondary data are the appropriate type of data to use for this study as it is unfeasible for me to collect primary data on this subject. The advantages of using secondary data include the ability of the researcher to gain a better understanding of the historical context of the subject and to analyze data collected at different times and in various locations (Frankfort-Nachmias & Nachmias, 2008). Furthermore, the use of secondary data enables the researcher to analyze patterns of change and the opportunity to describe the factors that may have caused these changes (Frankfort-Nachmias & Nachmias, 2008).

Using secondary data allowed me to have access to the largest databases on TB infection rates at both the state and national level. Since the data had already been collected, coded, and tabulated by the CDC, the reliability and validity of the data were very high and bias was minimal. It is quite unfeasible that I would have been able to collect these data on my own and, therefore, the only way this research could be carried out and accomplished was through the use of secondary data.

Methodology

Setting and Participants

In this study, I explored the effect of several demographic variables (immigration status, years of residence in the United States, and race/ethnicity) on TB infection rates among the population of the state of South Carolina between 2006 and 2012. Upon preliminary investigation of the CDC database, it was determined that the agency broke the aggregated data down into the study's variables and that the time frame indicated in this study was the most recent data set available and one that covered an adequate cross-section of time to allow for the most thorough examination of trends and correlations. In addition, this time frame was selected as it was the most relevant data on TB infection rates on both a nationwide and state level. Furthermore, this time frame is limited enough to allow for detailed analysis yet broad enough to allow for a thorough examination of trends in TB infection rates as relates to the study variables. For these specific reasons, it is believed that this specific time frame gave a good overview of TB

infection rates and how they relate to the specified demographic variables and allow for thorough comparisons on multiple levels.

Sampling and Sampling Procedures

As previously stated, this quantitative, nonexperimental cohort study used coded, archived, secondary data from the CDC that tracked TB rates in immigrants within South Carolina from 2006 to 2012. Once the data were accessed upon IRB approval, it was determined that the entire study population was 1188 ($N = 1188$). Therefore, all participants were coded and analyzed in the study and a sampling procedure was not necessary. As all of the research questions were tested on the same study population, the same population size was applicable for all research questions.

Procedures for Data Collection

All data for this study were collected from the CDC's secondary source database described in detail in following sections. Since the data were publicly accessible, no special permission was necessary to access the data from the CDC. No data were collected or analyzed until IRB approval for this proposal was obtained.

Instrumentation and Materials

It was assumed prior to data collection that the secondary data that were to be collected and analyzed from the CDC in Chapter 4 were categorized according to the independent variables being analyzed in this study, that is, immigration status, years of residence, and race/ethnicity. It was also assumed that all data that were to be collected

would be nonidentifiable and should be organized according to variable. Upon data

collection, these assumptions were proven to be accurate.

Data Analysis Plan

In this dissertation, I used the Statistical Package for Social Sciences (SPSS,

version 21.0) to analyze the data gathered for the study. In order to adequately explore

and analyze the characteristics of the cohort being evaluated, I used descriptive statistics

via linear regression models to compare and analyze the independent variables, both

individually and comparatively, against the dependent variable of TB infection status.

Multiple linear regression models were produced in order to analyze the associated

variables and yield inferential statistics to test the null and alternative hypotheses.

As stated by Mitchell and Jolley (2012), descriptive statistics enable researchers

to thoroughly analyze and describe the specific characteristics of a given research sample,

and inferential statistics permit the researcher to establish parameters and test hypotheses.

Linear regression is employed in studies to evaluate the probability of a disease or health

outcome as a function of a nondichotomous covariate, or risk factor, and is the

appropriate choice for the exploration of associations between different variables as it

allows for isolation of exposures and analysis of their impact on the independent and

dependent variables (CDC, 2014b). In addition, several authors in the literature review in

Chapter 2 used models that are also produced as part of linear regression analysis, such as

Pearson Correlations and *t-values*, to analyze the data used in their studies, thus providing

further support for the choice of linear regression as the statistical analysis for this dissertation.

As previously stated, the research questions that were analyzed for this quantitative study are:

RQ1:   What is the relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012?

$H1_o$:   There is no relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012.

$H1_A$:   There is a relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012.

The null hypothesis for RQ1 was tested using a multiple linear regression model in order to evaluate the relationship between immigration status and TB infection rates in South Carolina between 2006 and 2012. Before conducting the procedure, statistical procedures were conducted to define the degree to which the assumptions of the multiple linear regression were met.

RQ2:   What is the relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012?

$H2_o$:   There is no relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012.

$H2_A$:   There is a relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012.

The null hypothesis for RQ2 was tested using a multiple linear regression model in order to evaluate the relationship between years of residence in South Carolina and TB infection rates in South Carolina between 2006 and 2012. Before conducting the procedure, statistical procedures were conducted to define the degree to which the assumptions of the multiple linear regression were met.

RQ3: What is the relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012?

$H3_o$: There is no relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

$H3_A$: There is a relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

The null hypothesis for RQ3 was tested using a multiple linear regression model in order to evaluate the relationship between race/ethnicity and TB infection rates in South Carolina between 2006 and 2012. Before conducting the procedure, statistical procedures were conducted to define the degree to which the assumptions of the multiple linear regression were met.

Threats to Internal and External Validity

Due to the high reliability on secondary data that were used in this study, there were very few threats to internal and external validity. However, one threat to external validity was the possibility that the secondary data used in the study were not properly collected and/or catalogued at its origin. However, as has been previously stated, all

secondary data that were used in this study were obtained from a highly reputable

agency, the CDC, with institutes and maintains strict data collection, cataloguing, and

storage procedures. Therefore, the external threat should be minimal and not present a

risk to the reliability of this study.

Ethical Procedures

I submitted a Walden University Internal Review Board (IRB) application and

approval was granted in November 2014 by the institution via approval number 11-11-

14-0179432. No data were collected or analyzed for the purposes of this research study

until IRB approval was granted.

Protection of Human Participants

The potential risks to human participants as a result of this study were also

minimal. As no personally identifying information beyond TB infection status,

immigration status, years of residence, and race/ethnicity was included in the secondary

data obtained for the study, there was no feasible way for the data to be connected back to

individual participants nor can individual consent be retroactively obtained. As

previously stated, prior to collecting or analyzing data, IRB approval from Walden

University was obtained and strict procedures were followed when obtaining the data.

Once data were collected, they were stored on a secured, password protected computer

located in my residence. After collection and analysis of the secondary data, all

information will be retained in a secure location for 5 years. After the 5 years has

elapsed, I will securely destroy the data by permanently deleting the information from my computer's hard drive.

Summary and Transition

This quantitative study used coded archived data from the secondary sources previously listed. As stated, these data were analyzed using SPSS 21.0 statistical analysis and multiple linear regression tests were run to test the null and alternative hypotheses. The procedures used to collect the specified secondary data were rigorous and followed all established and required guidelines to ensure that the data were protected and not compromised in any way. These include the essential need for information, ensuring confidentiality, data security, and avoiding identification of participants. The results of the data analysis will be discussed in Chapter 4. In the final chapter, Chapter 5, a discussion of the results, conclusions, and recommendations for further scholarly research and study on the topic will be presented.

Chapter 4: Results

Chapter Overview

As previously stated, the purpose of this dissertation was to explore the

relationships between specific demographic variables and TB infection rates among the

population of South Carolina between 2006 and 2012. The focus of this chapter is to

analyze secondary data gathered from the CDC to determine if significant correlations

exist between any of the study variables, both individually and in conjunction, and TB

infection rates within South Carolina between 2006 and 2012 in order to support either

the null or alternative hypotheses for each of the following research question:

RQ1:   What is the relationship between immigration status and TB infection rates

among the population of South Carolina between 2006 and 2012?

$H1_o$:   There is no relationship between immigration status and TB infection rates

among the population of South Carolina between 2006 and 2012.

$H1_A$:   There is a relationship between immigration status and TB infection rates

among the population of South Carolina between 2006 and 2012.

RQ2:   What is the relationship between years of residence and TB infection rates

among the population of South Carolina between 2006 and 2012?

$H2_o$:   There is no relationship between years of residence and TB infection rates

among the population of South Carolina between 2006 and 2012.

$H2_A$:   There is a relationship between years of residence and TB infection rates

among the population of South Carolina between 2006 and 2012.

RQ3:　What is the relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012?

H3$_o$:　There is no relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

H3$_A$:　There is a relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

This chapter is organized into specific sections that detail how data were collected, how the data were compiled and analyzed, and the descriptive characteristics of the data as they relate to each independent variable and also an analysis of the correlations of the independent variables to each other. Sections within this chapter also include supporting data tables.

Data Collection

The secondary data that were analyzed in this study were obtained from the CDC's Online Tuberculosis Information System (OTIS) where the agency catalogued, tabulated, and tracked TB data from 1993 to 2012 for all 50 states and several U.S. territories (CDC, 2014c). In addition to year, geography, and the independent variables used in this dissertation, the data listed on OTIS were also grouped by age, gender, vital statistics, HIV status, homelessness, incarceration status, and various other searchable variables (CDC, 2014c).

CDC's OTIS database is part of the agency's Wide-ranging Online Data for Epidemiological Research (WONDER) system that makes public health data publicly

available for furthering the health and well-being of the general and specific populations

of the United States (CDC, 2014a). In addition to providing secondary data about TB via

OTIS, WONDER also provides public, searchable databases on HIV/AIDS, vaccinations,

birth/death rates, and cancer incidence (CDC, 2014a). Because of the strict protocols and

methods followed by the CDC, the quality of the secondary data gathered from OTIS and

used in this dissertation is high and concerns regarding threats to validity and reliability

are minimal. No personally identifiable information was divulged in the data produced

by OTIS and used in this dissertation, so threats to patient confidentiality were not a valid

concern.

Since the focus of this dissertation was to study specific independent variables

(immigration status, years of residence, and race/ethnicity) and to determine if any of

them alone or in conjunction had an impact on the dependent variable, TB infection rates

in South Carolina between 2006 and 2012, an OTIS data request was initiated that

queued the three independent variables in conjunction with South Carolina and limited

the search parameters to the specific date range of the study. The report generated by

OTIS listed 1,188 ($N = 1,188$) unique patients who had tested positive for TB in South

Carolina between 2006 and 2012. The OTIS report also classified each patient based on

the specified independent variables (see *Table 1*). I entered each patient ($N = 1,188$) into

SPSS 21.0 and coded them according to the values designated by the CDC in Table 1.

Table 1

OTIS Data

Race/Ethnicity	Immigration status	Years of residence	*N*
Asian or Pacific Islander, non-Hispanic	Foreign-born	Less than year	16
Asian or Pacific Islander, non-Hispanic	Foreign-born	1 to 4 years	27
Asian or Pacific Islander, non-Hispanic	Foreign-born	5 to 14 years	24
Asian or Pacific Islander, non-Hispanic	Foreign-born	15 plus years	43
Asian or Pacific Islander, non-Hispanic	US-born	Not applicable	15
Black or African American, non-Hispanic	Foreign-born	Less than 1 year	6
Black or African American, non-Hispanic	Foreign-born	5 to 14 years	5
Black or African American, non-Hispanic	US-born	Not applicable	660
Hispanic or Latino	Foreign-born	Less than 1 year	20
Hispanic or Latino	Foreign-born	1 to 4 years	81
Hispanic or Latino	Foreign-born	5 to 14 years	43
Hispanic or Latino	Foreign-born	15 plus years	12
Hispanic or Latino	US-born	Not applicable	33
Hispanic or Latino	Foreign-born	Not reported	5
White, non-Hispanic	US-born	Not applicable	198
Total (*N*)			1,188

Data Entry

The data gathered from OTIS were entered into SPSS 21.0 on a password protected computer and saved on a password protected external drive that was, and continues to be, kept in a secured location. OTIS specified unique values for each of the

independent variables used in this study and these were the values that were coded into SPSS and used for this study.

When entering the values for the variable of immigration status in SPSS, 0 was used to designate *U.S. born*, 1 was used to designate *Foreign born* and 99 was used to designate *Not applicable*. When entering the values for the variable of years of residence in SPSS, 0 was used to designate *0 – 1 years in U.S.*, 1 was used to designate *1 – 4 years in U.S.*, 2 was used to designate *5 – 14 years in U.S.*, 3 was used to designate *15 or more years in U.S.,* 9 was used to designate *Not reported*, and 99 was used to designate *Not applicable*. When entering the values for the variable of race/ethnicity in SPSS, 0 was used to designate *White, non-Hispanic*, 1 was used to designate *Black or African American, non-Hispanic*, 2 was used to designate *Hispanic or Latino*, 3 was used to designate *Asian or Pacific Islander, non-Hispanic*, 4 was used to designate *American Indian or Alaskan Native, non-Hispanic*, and 99 was used to designate *Not applicable*. Since all the subjects had a positive TB infection status, they were designated 0 for *Positive*.

In order for SPSS to run multiple linear regression analysis, one patient (No. 1189), was coded as TB infection status negative (coded 1 in SPSS for *Negative*). However, adding this one TB negative patient to the data analysis is not a concern and will not skew the data according to the Central Limit Theorem, also known as the Law of Large Numbers, that states that when a study population is large, the distribution of the

mean is always normal and the results of the data will not be affected or skewed (Fischer, 2011).

Data Analysis

As per the approved research proposal, once the data accessed from OTIS were entered into SPSS using the values previously described, they were analyzed via multiple linear regression models. In the analysis, TB infection status was listed as the dependent variable and with the three study variables (immigration status, years of residence, and race/ethnicity) as the independent variables. Analysis was run collectively on the independent variables with a 95.0% confidence interval, model fit, and a residual Durbin-Watson inquiry to ensure that the statistical model used was a good fit for the study variables (see Table 2). Since the result of the Durbin-Watson analysis was 0.277, this indicates that there was a positive correlation between the dependent and independent variables. Positive autocorrelation is quite common in multiple linear regression analysis, and since the results of the Durbin-Watson analysis was between 0 and 4, the results are considered normal and indicated that the analysis used, multiple linear regression, was the best choice for studying the effect of the independent variables on the dependent variable and testing the null and alternative hypotheses (Anderson, Sweeney, & Williams, 2011).

Furthermore, it is understandable that there would be a positive autocorrelation between the independent variables and the dependent variable in this study since, as explained in the literature review in Chapter 2, historically the independent variables

explored in this dissertation have had an impact on TB infection rates in past research. In

addition, according to Table 2, the standard error estimate was 0.007; this indicates the

margin of error was very small and that approximately 99.0% of the variability of the

dependent variable may be explained by the independent variables individually or in

combination.

Table 2

Model Summary

Study variables	R	R Square	Adjusted R Square	Std. error of estimate	Durbin-Watson
Immigration status years of residence Race/Ethnicity	1.000	1.000	1.000	0.007	0.277

As part of the multiple linear regression analysis that was computed on each

independent variable in relation to the dependent variable of TB infection status,

frequencies, coefficients, correlations, model summaries, ANOVAs, and histograms were

computed in an effort to test the compatibility of the model to the study and also to

support either the null or alternative hypothesis. To test the relationship collectively

between the independent variables, coefficient and correlation models were produced and

analyzed. In the following sections, the results of the analysis of each independent

variable in relation to the dependent variable as well as the relationship between all of the

independent variables and the associated statistical analysis and tables will be detailed.

Results of Data Analysis

Immigration Status and TB Infection Rate

The first research question of this study focused on analyzing the effect of immigration status (U.S. born versus foreign born) on TB infection rates in South Carolina between 2006 and 2012. To test the null and alternative hypotheses, the OTIS data that pertained to the immigration status of persons infected with TB in South Carolina during the study period was coded as either *U.S. born* or *Foreign born* and was entered into SPSS 21.0 with the values previously designated.

Of the study population ($N = 1,188$), 906 were born in the United States whereas 282 were foreign born (see Table 3). The significance levels in Table 4, Table 5, and Table 7 were all 0.000. Since these figures are less than 0.05, the data indicate that the independent variable of immigration status does statistically significantly predict or impact the dependent variable of TB infection status, thus supporting the alternative hypothesis ($H1_A$: There is a relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012; Liu, 2013). In further support of the alternative hypothesis, the coefficients between the dependent variable of TB infection status and the independent variable of immigration status yielded a *t-value* of 231.929 with a *df* of 1 (Table 4 and Table 7). These figures are used to calculate a *p* value of 0.002745 that is considered to be a low *p* value because it is 0.05 or below (Liu, 2013). When the *p* value is below 0.05, the results suggest a decreased level

of compatibility between the data and null hypothesis that in turn supports the alternative

hypothesis (Liu, 2013).

Table 3

Immigration Status Frequency

Immigration Status	Frequency	Percent	Valid percent	Cumulative percent
U.S born	906	76.3	76.3	76.3
Foreign born	282	23.7	23.7	100.0
Total	1188	100.0	100.0	

Table 4

Coefficients Between the Dependent Variable and the Independent Variable of Immigration Status Via Multiple Linear Regression

Immigration Status	Unstandardized coefficients	Standardized coefficients (Beta)	t value	Significance
U.S born	-0.231 (Std. Error 0.012)	0.989	-18.759	0.000
Foreign born	0.981 (Std. Error 0.004)	0.989	231.929	0.000

The alternative hypothesis indicating that there is a significant relationship

between immigration status and TB infection rates in South Carolina between 2006 and

2012 is further supported by the Pearson Correlation in *Table 5* that indicates a 98.9%

correlation between the dependent and independent variable, with a 0.000 (100%)

significance level. The correlation is the same in *Table 6* with an *r-value* of 98.9% and

an adjusted *r-square* of 97.8%.

Table 5

Bivariate Correlations Between the Dependent Variable of TB Infection and the Independent Variable of Immigration Status

Immigration Status	Pearson Correlation	Significance (2-tailed)	N
U.S or Foreign Born	0.989	0.000	1189

Table 6

Immigration Status Model Summary

Immigration Status	*R*	*R* Square	Adjusted *R* square	Std. error of estimate
U.S or Foreign Born	0.989	0.978	0.978	0.422

The ANOVA in Table 7 has an *f-value* of 53791.010 that is statistically

significant since it is well above 1.0 and indicates a strong correlation between the

independent and dependent variables and further supports the findings of the *t-value* and

p-value and its impact on disproving the null hypothesis and supporting the alternative

hypothesis. Since the significance value in *Table 7* is less than 0.05, this figure provides

evidence that there is a significantly low probability that the variation detailed in the

ANOVA and the results of the analysis are due to chance and that the accuracy of the

analysis is relatively high (Liu, 2013).

Table 7

Immigration Status ANOVA

Immigration Status, U.S. or Foreign Born	Sum of squares	*df*	Mean square	*f-value*	Significance
Regression	9581.327	1	9581.327	53791.010	0.000
Residual	211.430	1187	0.178		
Total	9792.757				

The histogram represented in Figure 1 shows a somewhat normal curve with no significant left or right tails that indicates a normal distribution and no skewing of data (Liu, 2013).

Histogram

Dependent Variable: Infection Status

Mean = -2.30E-16
Std. Dev. = 1.000
N = 1,189
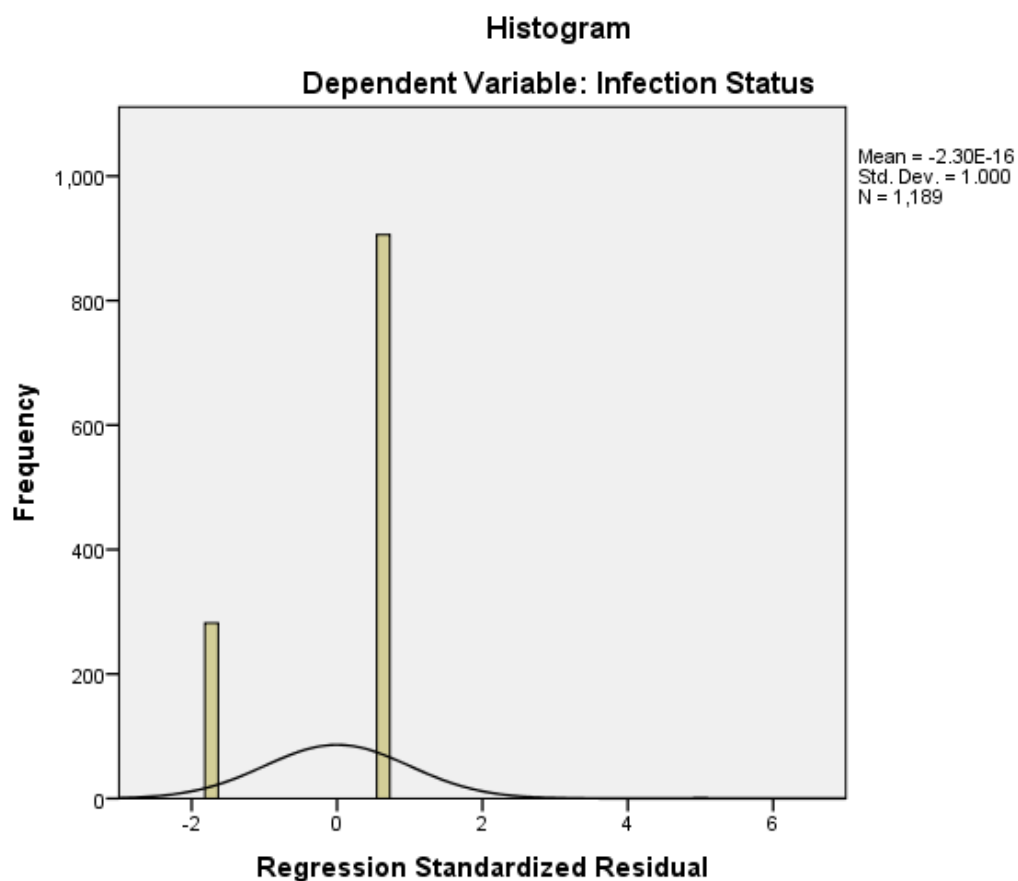
Figure 1. Immigration status histogram.

Years of Residence and TB Infection Rate

The second research question of this study focused on analyzing the effect of years of residence on TB infection rates in South Carolina between 2006 and 2012. To test the null and alternative hypotheses, the OTIS data that pertained to the years of residence of persons infected with TB in South Carolina during the study period was coded as indicated in Table 8 and was entered into SPSS 21.0. Of the study population (N=1188), 42 had resided in the U.S. for less than 1 year, 108 from 1 to 4 years, 72 from

5 to 14 years and 55 for 15 or more years; 906 were not applicable and 5 did not report their years of residency (Table 8).

The significance levels in Table 9, Table 10 and Table 12 were all 57.7%. Since these figures are greater than 0.05, the data in relation to the independent variable of years of residence did not statistically significantly predict or impact the dependent variable of TB infection status thus supporting the null hypothesis (*H2$_o$:* There is no relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012) (Liu, 2013). In further support of the null hypothesis, the coefficients between the dependent variable of TB infection status and the independent variable of immigration status yielded a *t-value* of 0.557 with a *df* of 1 (Table 9 and Table 12). These figures are used to calculate a *p-value* of 0.676469 that indicates that the result is not significant since the *p-value* is above 0.05. When the *p-value* is above 0.05, the results suggest that the findings of the data analysis support the null hypothesis and reject the alternative hypothesis (Liu, 2013).

Table 8

Years of Residence Frequency

Years of Residence	Frequency	Percent	Valid Percent	Cumulative percent
0 – 1 Years	42	3.5	3.5	3.5
1 – 4 Years	108	9.1	9.1	12.6
5 – 14 Years	72	6.1	6.1	18.7
15 or More Years	55	4.6	4.6	23.3
Not Reported	5	0.4	0.4	23.7
Not Applicable	906	76.3	76.3	100.0
Total	1188	100.0	100.0	

Table 9

Coefficients Between the Dependent Variable of TB Infection and the Independent Variable of Years of Residence Via Multiple Linear Regression

Years of Residence	Unstandardized coefficients	Standardized coefficients (Beta)	t value	Significance
Constant	-0.002 (Std. Error 0.174)	0.016	-0.010	0.992
Total Number of Years of Residence	0.001 (Std. Error 0.002)	0.016	0.557	0.577

The null hypothesis indicating that there is no significant relationship between years of residence and TB infection rates in South Carolina between 2006 and 2012 is further supported by the Pearson Correlation in Table 10 that indicates a 1.6% correlation

between the dependent and independent variables (Liu, 2013). The correlation is the

same in Table 11 with an *r-value* of 1.6% and an adjusted *r-square* of less than 1.

Table 10

Bivariate Correlations Between the Dependent Variable of TB Infection and the Independent Variable of Years of Residence

Years of Residence	Pearson Correlation	Significance (2-tailed)	N
Number of Years Person has Resided in U.S.	0.016	0.577	1189

Table 11

Years of Residency Model Summary

Study variables	*R*	*R* Square	Adjusted *R* square	Std. error of estimate
Number of Years Person has Resided in U.S.	0.016	0.000	-0.001	2.872

The ANOVA in Table 12 has an *f-value* of 0.311 that is not statistically

significant since it is below 1.0 and does not indicate a strong correlation between the

independent and dependent variables and further supports the findings of the *t-value* and

p-value and its impact on supporting the null hypothesis and disproving the alternative

hypothesis (Liu, 2013). Since the significance value in Table 12 is close to 0.05, this

figure provides evidence that there is a significantly low probability that the variation

detailed in the ANOVA and the results of the analysis are due to chance and that the

accuracy of the analysis is relatively high (Cunningham & Aldrich, 2012)

Table 12

Years of Residence ANOVA

Years of Residence	Sum of squares	df	Mean square	f-value	Significance
Regression	2.562	1	2.562	0.311	0.577
Residual	9790.195	1187	8.248		
Total	9792.757	1188			

The histogram represented in Figure 2 shows a normal curve with no left or right tails that indicates a normal distribution and no skewing of data (Liu, 2013).

Histogram
Dependent Variable: Infection Status

Mean = 6.94E-18
Std. Dev. = 1.000
N = 1,189
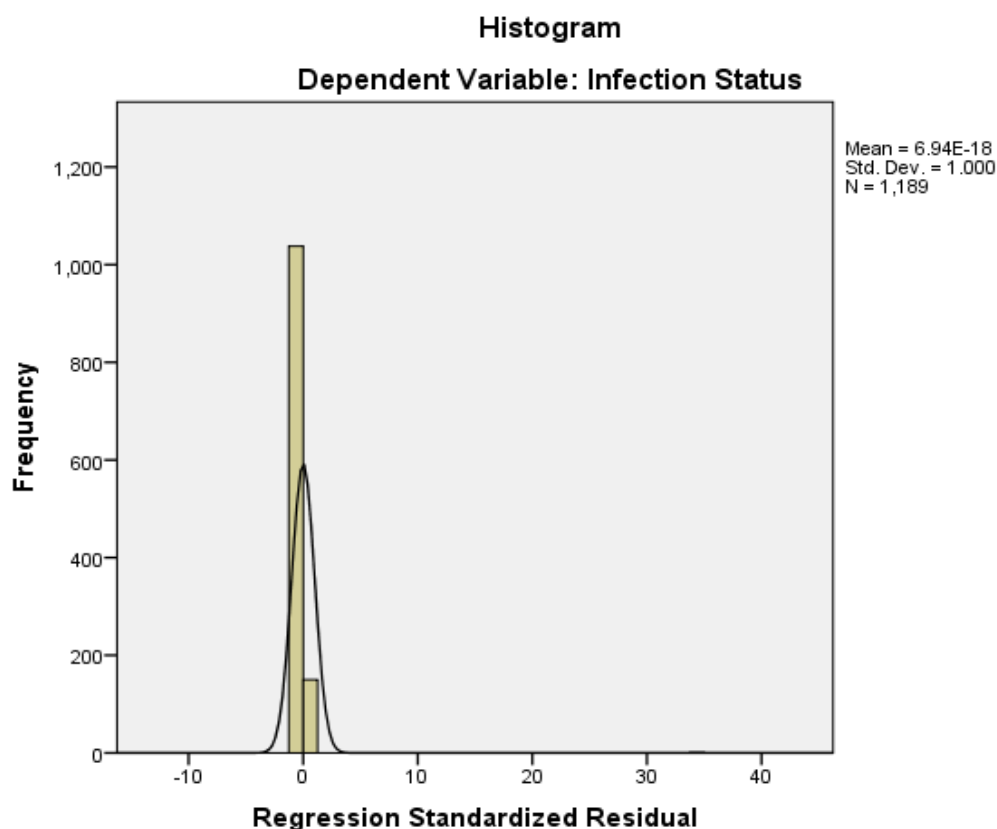
Figure 2. Years of residence histogram.

Race/Ethnicity and TB Infection Rate

The third research question in the study focused on analyzing the effect of race/ethnicity on TB infection rates in South Carolina between 2006 and 2012. To test the null and alternative hypotheses, the OTIS data that pertained to race/ethnicity of persons infected with TB in South Carolina during the study period was coded as indicated in Table 13 and was entered into SPSS 21.0. Of the study population (N=1188), 198 were classified as White, Non-Hispanic, 671 were classified as Black or African American, Non-Hispanic, 194 were classified as Hispanic or Latino and 125 were classified as Asian or Pacific Island, Non-Hispanic (Table 13).

The significance levels in Table 14, Table 15 and Table 17 were all 0.001. Since these figures are less than 0.05, the data indicates that the independent variable of race/ethnicity does statistically significantly predict or impact the dependent variable of TB infection status thus supporting the alternative hypothesis ($H3_A$: There is a relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.) (Liu, 2013). In further support of the alternative hypothesis, the coefficients between the dependent variable of TB infection status and the independent variable of race/ethnicity yielded a *t-value* of 3.317 with a *df* of 1 (Table 14 and Table 17). These figures are used to calculate a *p-value* of 0.018641 that is considered to be a low *p-value* because it is below 0.05 (Liu, 2013). When the *p-value* is below 0.05, the results suggest a decreased level of compatibility between the data and null hypothesis that in turn supports the alternative hypothesis and rejects the null hypothesis (Liu, 2013).

Table 13

Race/Ethnicity Frequency

Race/Ethnicity	Frequency	Percent	Valid percent	Cumulative percent
White, Non-Hispanic	198	16.7	16.7	16.7
Black or African American, Non-Hispanic	671	56.5	56.5	73.1
Hispanic or Latino	194	16.3	16.3	89.5
Asian or Pacific Island, Non-Hispanic	125	10.5	10.5	100.0
Total	1188	100.0	100.0	

Table 14

Coefficients Between the Dependent Variable of TB Infection and the Independent Variable of Race/Ethnicity via Multiple Linear Regression

Race/Ethnicity	Unstandardized coefficients	Standardized coefficients (Beta)	t value	Significance
Constant	-0.310 (Std. Error 0.174)	0.096	-2.144	0.0325
Race/Ethnicity	0.325 (Std. Error 0.098)	0.096	3.317	0.001

The alternative hypothesis indicating that there is a statistically significant relationship between race/ethnicity and TB infection rates in South Carolina between 2006 and 2012 is further supported by the Pearson Correlation in Table 15 that indicates a 9.6% correlation between the dependent and independent variables (Liu, 2013). The

correlation is the same in Table 16 with an *r-value* of 9.6% and an adjusted *r-square* of 0.8%.

Table 15

Bivariate Correlations Between the Dependent Variable of TB Infection and the Independent Variable of Race/Ethnicity

Race/Ethnicity	Pearson Correlation	Significance (2-tailed)	N
Ethnic Background	0.096	0.001	1189

Table 16

Race/Ethnicity Model Summary

Study variables	*R*	*R* Square	Adjusted *R* Square	Std. error of estimate
Ethnic Background	0.096	0.009	0.008	2.859

The ANOVA in Table 17 has an *f-value* of 11.0 that offers further support the alternative hypothesis since it significantly above 1.0 that is the standard for proving the alternative hypothesis (Cunningham & Aldrich, 2012).

Table 17

Race/Ethnicity ANOVA

Race/Ethnicity	Sum of squares	*df*	Mean square	*f-value*	Significance
Regression	89.914	1	89.914	11.000	0.001
Residual	9702.843	1187	8.174		
Total	9792.757	1188			

The histogram represented in Figure 3 shows a normal curve with no left or right tails that indicates a normal distribution and no skewing of data (Liu, 2013).
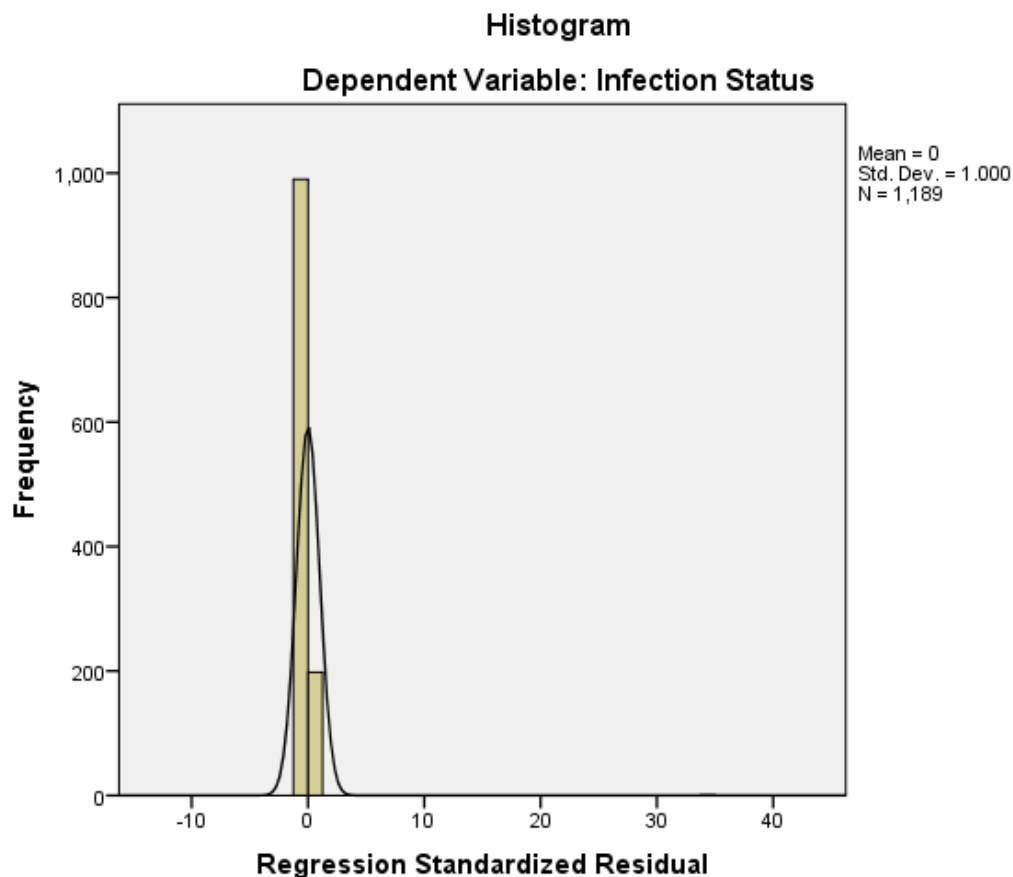
Figure 3. Race/ethnicity histogram.

Analysis of All Independent Variables to the Dependent Variable

In order to analyze the individual and collective relationships between each

independent variable and the dependent variable of TB infection rates in South Carolina

between 2006 and 2012, multiple regression models were run to test coefficients and

correlations. The significance levels for the independent variables in relation to each

other in Table 18 and Table 19 were all 0.000, except for the relationship between ethnic

background that was 0.002 (Table 19). Since all of the significance levels were less than

0.05, the data indicates that all of the independent variables (i.e. immigration status, years of residence and race/ethnicity) do collectively statistically significantly predict or impact the dependent variable of TB infection status (Liu, 2013).

The coefficients between the dependent variable of TB infection status and the independent variables yielded *t-values* ranging from 14149.545 (immigration status), 1396.712 (years of residence) and -3.141(race/ethnicity) with a *df* of 3 (Table 18). These figures are used to calculate *p-values* of 0.00001 for the independent variables of immigration status and years of residence and a *p-value* of 0.025812 for race/ethnicity. Even though the *p-value* for race/ethnicity is higher than the *p-values* for the other two independent variables, they are all considered to be low *p-values* because they are below 0.05 (Liu, 2013). When a *p-value* is below 0.05, the results suggest a correlation and a statistically significant relationship between the variables being compared (Liu, 2013).

Table 18

Coefficients Between the Dependent Variable of TB Infection and the Independent Variables of Immigration Status, Years of Residence and Race/Ethnicity

	Unstandardized coefficients	Standardized coeffecients (Beta)	t value	Significance
Constant	-1.014 (Std. error 0.174)		-1063.864	0.000
U.S. Born or Foreign Born	1.000 (Std. error 0.000)	0.000	14149.545	0.000
Years of Residence	0.010 (Std. error 0.000)	0.148	1396.712	0.000
Race/Ethnicity	-0.001 (Std. error 0.000)	0.000	-3.141	0.002

A model that provides a clearer analysis of the relationship between the independent variables are the Pearson Correlations in Table 19. The Pearson Correlation between the independent variables of immigration status and years of residence was -13.0% that indicates a negative correlation between the two independent variables (Liu, 2013). The Pearson Correlation between the independent variables of immigration status and race/ethnicity was 20.6% that indicates a positive correlation between the two independent variables (Liu, 2013). The Pearson Correlation between the independent variables of years of residence and race/ethnicity was -75.3% that indicates a negative correlation between the two independent variables (Liu, 2013). As indicated by the Pearson Correlations in Table 19, each of the independent variables have statistically

significant correlations with each other, although only one relationship, the one between

the independent variables of immigration status and race/ethnicity had a positive

correlation. However, the negative correlations between the other independent variables

still indicates a relationship between all the independent variables and further supports

the impact they all have, both separately and collectively, on the dependent variable of

TB infection status among immigrants within South Carolina between 2006 and 2012.

Table 19

Bivariate Correlations Between the Dependent Variable of TB Infection and the
Independent Variables of Immigration Status, Years of Residence and Race/Ethnicity

	Independent variable	Infection status	Immigration status	Years of residence	Race/ Ethnicity
Pearson Correlation	Immigration Status	0.989		-0.131	0.206
	Years of Residence	0.016	-0.131		-0.753
	Race/Ethnicity	0.096	0.206	-0.753	
Significance (1-tailed)	Immigration Status	0.00		0.00	0.00
	Years of Residence	0.289	0.00	0.00	
	Race/Ethnicity	0.00		0.00	0.00

Summary and Transition

As detailed in this chapter, for each research question, a series of analytic tests via

linear regression were run on the OTIS data that individually and collectively compared

the dependent and independent variables and produced various statistical models and

analysis that supported one of the hypotheses and showed soundness in the statistical

method chosen for this study. Narratives were given for each independent variable based

on the data analysis to indicate whether or not the results supported the null or alternative hypothesis.

Of the three independent variables and hypotheses examined, two supported the alternative hypotheses (immigration status and race/ethnicity) and one supported the null hypothesis (years of residence). In fact, the data showed that immigration status was a statistically significant predictor of TB infection rates among the study population and had a much higher correlation with the dependent variable than the other two independent variables put together. In addition, multiple linear regression models were run to test the correlations and coefficients of the independent variables both individually and collectively. Of the relationships tested between the independent variables, all of the correlations were negative except for the relationship between immigration status and race/ethnicity. The interpretation of findings will be discussed in more detail in Chapter 5 as well as impact for social change, recommendations for action and further study.

Chapter 5: Discussion, Conclusions and Recommendations

Introduction

As highlighted in this study, public health authorities have known for quite some time that certain populations are at a higher risk for contracting TB than others. By studying these high-risk populations and identifying factors that make them more vulnerable than other populations for contracting TB, public health workers have the ability to reduce the incidence of TB in all populations.

One of the groups most at risk for contracting TB within the United States are immigrants. Even though cases of TB have declined among the native population of the United States over the last several decades, between 1986 and 2010 cases of TB among immigrants rose from less than 25.0% of the overall cases of TB within the United States to 60.0% (Olson et al., 2012). TB rates among immigrants rose from 3.8% in 1990 to 11.3% in 2010 (Olson et al., 2012). Since TB is a highly infectious, airborne disease and certain strains are becoming antibiotic resistance, the increasing number of TB cases among immigrants within the United States has become a serious health concern not only among the immigrant population but also among the general population of the United States as well.

It is for these reasons that I chose to focus on examining relationships between the impact of specific immigration variables (immigration status, years of residence, and race/ethnicity) on TB infection rates in South Carolina between 2006 and 2012. Three research questions were compiled that offered null and alternative hypotheses and that

had as their purpose an attempt to draw correlations between the dependent variable, TB infection status, and the independent variables individually. In Chapter 4, statistical analysis was run via linear regression in SPSS 21.0, and a brief overview was given of the findings of each. In this chapter, a more thorough discussion of each statistical analysis for the independent variables and its support of either the null or alternative hypothesis will be given as well as the limitations of the study and recommendations for action and further study. In the next sections, I will discuss each independent variable in relation to the data analysis ran in Chapter 4 and the literature review conducted in Chapter 2.

Interpretation of the Findings

In Chapter 4, the data analysis and results for each independent variable as related to the dependent variable of TB infection status was reported as well as whether the findings supported the null or alternative hypothesis for each research question. As indicated in Chapter 4, of the three independent variables and hypotheses examined, two supported the alternative hypothesis (immigration status and race/ethnicity) and one supported the null hypothesis (years of residence). Indeed, the data showed that immigration status was a statistically significant predictor of TB infection rates among the study population and had a much higher correlation with the dependent variable than the other two independent variables put together.

From the results of the data analysis, it is the determination of this study that the most significant predictor of TB infection rates within South Carolina was immigration

status (U.S. or foreign born) with a 98.9% correlation between the independent and

dependent variables. Race/ethnicity had a 9.6% correlation with the dependent variable

whereas years of residence had a 1.6% correlation with the dependent variable.

Therefore, the alternative hypotheses were supported for RQ1 and RQ3:

$H1_A$:   There is a relationship between immigration status and TB infection rates

among the population of South Carolina between 2006 and 2012.

$H3_A$:   There is a relationship between race/ethnicity and TB infection rates

among the population of South Carolina between 2006 and 2012.

Whereas the null hypothesis was supported for RQ2:

$H2_o$:   There is no relationship between years of residence and TB infection rates

among the population of South Carolina between 2006 and 2012.

Immigration Status and TB Infection Rate

The data analyzed in Chapter 4 in relation to the independent variable of

immigration status statistically significantly predicts or impacts the dependent variable of

TB infection status, thus supporting the alternative hypothesis for RQ 1:

$H1_A$: There is a relationship between immigration status and TB infection rates

among the population of South Carolina between 2006 and 2012.

The fact that the results of the data analysis showed a statistically significant

correlation between the independent variable of immigration status and the dependent

variable of TB infection status is in alignment with the results of studies highlighted in Chapter 2 that were conducted among comparable populations and supports those conclusions and hypotheses.

As was detailed in Cain et al. (2012), the current rate of TB infection among the immigrant population within the United States is significantly higher than TB rates among the population born within the United States (Cain et al., 2012). The sensitivity analysis conducted by Cain et al. was performed in Tennessee, a state similar to South Carolina in geography, demographics, and other variables, found that even though only 17.0% of the TB tests conducted during the article's study period were given to foreign-born residents of Tennessee, this population had a disproportionally higher incident rate of TB (33.0%) than did the U.S. born population who participated in the study (5.0%; Cain et al., 2012).

Olson et al. (2012) used a Poisson regression model to explore correlations between SES and TB rates among a cross section of citizens in the United States through data obtained through the ZIP Code Tabulation Area (ZCTA) collected in the 2000 U.S. census (Olson et al., 2012). The results of the analysis indicated that of the 170,590 verified cases of TB in the United States from 1996 to 2005, over half of the study's populations, 52.2%, were immigrants (Olson et al., 2012). Person et al.'s (2010) retrospective, cross-sectional study of workers in North Carolina also found a high correlation between immigrants and TB infection rates (Person et al., 2010). As with

Cain et al. the study population represented in Person et al. was similar in many factors to the cohort in this study (Person et al., 2010).

As indicated, the findings of Cain et al. (2012), Olson et al. (2012), and Person et al. (2010) are consistent with the results of this study and offer credence to the support of the data analysis presented in Chapter 4 that shows significant statistical support for the alternative hypothesis for RQ 1.

Years of Residence and TB Infection Rate

The data analyzed in Chapter 4 in relation to the independent variable of years of residence does not statistically significantly predict or impact the dependent variable of TB infection status, thus supporting the null hypothesis for RQ 2:

$H2_o$: There is no relationship between years of residence and TB infection rates among the population of South Carolina between 2006 and 2012.

The fact that the results of the data analysis of this dissertation supported the null hypothesis is in alignment with the results of studies highlighted in Chapter 2 and that were conducted in comparable populations. Willis et al. (2012) conducted a time series decomposition analysis of TB that were reported to the CDC between 1993 and 2008. The results of the study indicated that the highest rates (26.1%) were among immigrants with less than 1 year of residence within the United States (Willis et al., 2012). The Willis et al. study was comparable to this dissertation in terms of geographical area and time period and the correlation of their population between the independent variable of

years of residence and dependent variable of TB infection status and its findings was similar to the results of the data analysis of this study.

The study by Liu et al. (2012) was a retrospective cross-sectional analysis of data obtained from the Department of Homeland Security, CDC, and WHO between 2001 and 2008 in order to examine the impact of length of residence among immigrants on TB infection rates in the United States. The authors found that immigrants seeking permanent residence and refugees from high-burden TB countries who had resided in the United States for less than 1 year accounted for the highest percentage (41.6%) of TB cases among the study population (Liu et al., 2012). The study population of the Liu et al. study was similar to the participants in this study in terms of geography and secondary data, thus offering a good comparison sample and support for the findings of this dissertation.

As indicated, the findings of Willis et al. (2012) and Liu et al. (2012) are consistent with the results of this study and offer credence to the support of the data analysis presented in Chapter 4 that shows significant statistical support for the null hypothesis for RQ 2.

Race/Ethnicity and TB Infection Rate

The data analyzed in Chapter 4 in relation to the independent variable of race/ethnicity statistically significantly predicts or impacts the dependent variable of TB infection status, thus supporting the alternative hypothesis for RQ 3:

H3$_A$:   There is a relationship between race/ethnicity and TB infection rates

among the population of South Carolina between 2006 and 2012.

In the quantitative cohort study conducted by Walter et al. (2014), that examined Filipino immigrants who entered the United States through California between 2001 and 2002, the authors also found a correlation between race/ethnicity and TB infection rates. However, the authors did not find a correlation between years of residence and TB infection rates in their study (Walter et al., 2014). Both of these findings by Walter et al. are in support of the results of the data analysis in this dissertation for both RQ2 and RQ3.

Barrington et al. (2012) conducted a qualitative community-based research study to examine the history of the Latino population in South Carolina and the dynamics created by the increase of this community in the 21st century (Barrington et al., 2012). The results of the study indicated a statistically significant relationship between TB infection rates and race/ethnicity that also supports the findings of the data analysis of this dissertation (Barrington et al., 2012).

As indicated, the findings of Walter et al. (2014) and Barrington et al. (2012) are consistent with the results of this study and offer credence to the support of the data analysis presented in Chapter 4 that shows significant statistical support for the alternative hypothesis for RQ3.

Comparing All Independent Variables to the Dependent Variable

The data analyzed in Chapter 4 indicated a correlation between each independent variable and the dependent variable of TB infection rates in South Carolina between 2006 and 2012. The significance levels, t values, and p values produced by the data analysis indicated that each of the independent variables (i.e., immigration status, years of residence, and race/ethnicity) do collectively statistically significantly predict or impact the dependent variable of TB infection status. The data analysis also indicated that each of the independent variables do have a statistically significant correlation with the other independent variables: The correlation between immigration status and years of residence was a negative correlation at -13.0%, the correlation between immigration status and race/ethnicity was a positive correlation at 20.6%, and the correlation between years of residence and race/ethnicity was a negative correlation at -75.3%.

The positive correlation between the independent variables of immigration status and race/ethnicity further supports the findings of the analysis of each individual independent variable against the dependent variable because the two alternative hypotheses that the individual data analyses supported were as follows:

RQ1: *H1$_A$:* There is a relationship between immigration status and TB infection rates among the population of South Carolina between 2006 and 2012.

RQ3: *H3$_A$:* There is a relationship between race/ethnicity and TB infection rates among the population of South Carolina between 2006 and 2012.

The positive correlation between the independent variables of immigration status and race/ethnicity are further supported by the findings in articles in Chapter 2 and that were discussed in specific detail previously in this chapter, specifically the results in the articles by Barrington et al. (2010), Cain et al. (2012), Person et al., (2012), and Walter et al. (2014).

Summary of Interpretations

The findings of this study are, as stated previously, in alignment with the literature review conducted in Chapter 2 that, combined with the data analysis conducted in Chapter 4, give support and validation to the study overall. Furthermore, the conclusions of this dissertation support the tenants of the ecological perspective theory that focuses on the interaction of factors in all aspects of a health problem on three specific levels: intrapersonal, interpersonal, and community (National Cancer Institute, 2005). In relation to this dissertation and the ecological perspective theory, on the intrapersonal level, correlations were explored between TB infection rates and race/ethnicity within the population of South Carolina between 2006 and 2012. Interpersonal factors are relevant to the correlation between immigrant status and years of residence in South Carolina and TB rates as the social networks populations find themselves in and who they associate with could potentially put them at risk for contracting TB. The findings from this study indicate that two variables associated with immigration variables (immigration status and race/ethnicity) statistically significantly impact TB infection rates within South Carolina.

Limitations

There are several acknowledged limitations of this study. First, in regards to the independent variable of years of residence, of the study population ($N = 1,188$), 906 were labeled as *Not applicable* and five did not report their years of residency in the OTIS CDC data. This represents 76.6% of the study population. The fact that such a large portion of the study population did not report their years of residence could call the findings and data analysis into question in regards to whether or not years of residence have a statistically significant impact on TB infection rates within South Carolina during the study period. As indicated in Chapter 4, the data analysis supported the null hypothesis and found no statistically significant relationship between years of residence and TB infection rates, but with only 23.4% of the study population reporting on this variable, the results are limited and could be significantly skewed. One way to address this limitation in future studies is through more thorough screenings and reporting and coding of secondary data. However, there is no way for me to address this particular limitation in this study.

Another limitation in this study, and one that was acknowledged in most of the studies highlighted in the literature review in Chapter 2, is that it is often difficult to track the TB infection status of immigrants. This limitation is because immigrants frequently do not seek medical care due to many factors such as illegal status, lack of financial resources and/or insurance, and the social stigmas that are associated with the disease that lead to a fear of being ostracized within their community if they are diagnosed with TB.

One way to address this limitation is for local and state public health authorities to conduct public health campaigns that are aimed at the immigrant population that provide education about symptoms and risk factors associated with TB, promise no recriminations in regards to illegal immigration status, and help to reduce social stigmas among communities.

Implications for Social Change

The implications for social change of this research are multi-dimensional and extend beyond the borders of South Carolina. First, by analyzing the results of this study, public health workers have the potential to decrease the incidence and prevalence of TB among all populations within the state, geographical region and nationwide through the targeting of specific immigrant groups for ongoing TB testing, counseling and public health education regarding how the disease is contracted, spread, and the general symptoms of TB. Through such education, not only would awareness be raised among the target population but the information would also disseminate into the larger population which would provide education for the community at large. And, through such education, social stigmas surrounding TB could be diffused that would hopefully result in those in the most at risk groups willingly participating in TB testing and treatment if diagnosed with the disease.

The results of this study also have the potential to provide assistance to public health agencies on the local and state levels in receiving and allocating resources more efficiently in the ongoing fight against TB. Furthermore, by identifying which groups are

at the highest risk for contracting TB and exposing the general population to the disease, public health professionals have the ability to target valuable and limited resources to the populations which are most at risk and vulnerable. All of these factors would not only decrease the physical, economical and emotional drain of TB on patients and public health authorities, they would also serve a greater societal good by reducing the burden of TB on all populations at all levels.

Recommendations for Action

The findings of my study indicate the importance of examining and understanding specific variables that impact TB infection rates and taking actions to address those variables that have the most significant correlations. Based on the data analysis in Chapter 4, statistically significant predictors were found between immigration status (U.S. or foreign born) and race/ethnicity and TB infection status within South Carolina between 2006 and 2012. These findings would be particularly interesting to local and state officials within South Carolina as they would have the ability to focus resources on specific populations within the state that are most at risk for having TB and also spreading the disease to others within their community. The research and data analysis conducted in this dissertation provides a valid and statistically sound examination of some of the variables that impact TB infection rates among immigrants within South Carolina and provides justification for action and further study and exploration.

Recommendations for Further Study

While this dissertation found statistically significant correlations between two specific immigration variables (immigration status and race/ethnicity) and TB infection status within South Carolina between 2006 and 2012, research is still needed regarding more specific variables and correlations such as whether or not immigrants from specific high burden TB countries pose a greater TB exposure threat to the population of the state than other immigrant groups. Also, even though I found no statistically significant correlation between years of residence and TB infection rates in South Carolina during the study period, further studies need to be conducted on whether or not years of residence historically (such as pre-2006) and going forward (such as after 2012) were and could be significant predictors of TB infection rates.

Conclusion

TB is a disease that has plagued humanity for tens of thousands of years and one that continues to wreak havoc on populations worldwide despite advances in medicine, treatment, and public health practices well into the second decade of the 21st century (Sharma & Mohan, 2013). The purpose of this study was to explore the impact of certain immigration factors (immigration status, years of residence, and race/ethnicity) on TB infection rates in South Carolina between 2006 and 2012. By gaining an understanding of the impact of these variables on TB infection status, it is hoped that public health workers within the state and without will be able to garner a better understanding of

which populations are most at risk and, through such knowledge, have the ability to focus

valuable resources on those groups most vulnerable for contracting TB.

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