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The Relationship Between Chlamydia, Gonorrhea, Syphilis and Race, Gender, and Age

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Walden University
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Abstract

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MPH, Walden University, 2011

MA, Arkansas State University, 1996

BA, Arkansas State University, 1994

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

The purpose of this quantitative correlational design using secondary data from Colorado Department of Public Health and Environment was to examine the relationship between different types of sexually transmitted infections (STIs), specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age in the United States. This study is significant because it could assist medical personnel to focus on more personally-based STI treatments. This study could also lead to a call for more research regarding sexual health programs across the nation, individuals' willingness to share personal information regarding STIs, and how sexual health programs could increase testing for STIs. The study may also assist in the understanding of how healthcare workers consider demographic information, such as race, gender, and age for treating chlamydia, gonorrhea, and syphilis infections. The socio-ecological model was the theoretical foundation for this study with a quantitative cross-sectional, nonexperimental correlational design using nonprobability sampling. Multiple and logistic regression were used to test hypotheses. The key findings of the study demonstrated that age sex, and race predicted chlamydia, gonorrhea, and syphilis infection status in separate regression models. Implications for positive social change include the importance of targeting specific demographic characteristics to spread awareness about, educate, and prevent chlamydia, gonorrhea, and syphilis infections among individuals and potential sexual partners.

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Dedication

I would like to respectfully dedicate this dissertation to my parents Johnny & Mary McGrew who have been actively engaged in my academic success and personal development since childhood. I would also like to dedicate my dissertation work to my collegiate Track & Field Coach Jay Flannigan for encouraging me to be as successful as humanly possible and to treat my fellow humans with the same level of respect that I desire from them.

Finally, I would like to say thank you to my mentor and friend the late Dr. Lawrence Salinger of Arkansas State University. Dr. Salinger taught me honor and humility along with challenging me academically. Before his untimely passing, Dr. Salinger personally motived me to obtain my doctoral degree; and for that I would like to sincerely thank him for mentoring me during my personal and professional development.

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Finally, I would like to thank my Dissertation Chair Dr. Patrick Tschida. Dr. Tschida is one of a kind he not only guided me during my dissertation he provided me with letters of recommendation for employment opportunities. In short, I could not have asked for a better mentor. I would be remiss if I did not thank my committee member Dr. Callahan-Myrick who provided me with in depth feedback during the prospectus and proposal phase of my research.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

The healthcare sector forms an important part of the world's economy as it entails provision of essential services. This makes them an important aspect of the economic development and growth in the country and beyond. The economy of the United States has experienced rapid growth over the past decade (De Wolf & Toebes, 2016). However, these health structures experience slow growth which makes them appear to be growing into feeble businesses that are susceptible to winding up. This is because the performance of the businesses is influenced by the internal community misunderstandings regarding the management and financial control.

According to Hodge (2008), community health contributes to over 90% of the country's economic activities. Most of the community health management structures are young having been established from the 1980s onwards. These structures have diversified operations with the majority getting involved in financial services, trading, and construction and real estate services in the U.S. economy.

Sexually transmitted infections (STI) such as chlamydia, gonorrhea, and syphilis continue to be significant burdens to the health of individuals (Deziel et al., 2018; Lochner & Maraqa, 2018; Owusu-Edusei et al., 2013; Pultorak et al., 2009). The main aim of the study was to evaluate the relationships between chlamydia, gonorrhea, and syphilis infections and race, gender, and age among infected individuals in the United States. The equity financing majorly constitutes the medical structure for most of the families.

Background

According to the Center for Disease Control and Prevention (CDC, 2014), the most reported infection in the United States is the chlamydia trachomatis infection. A significant percentage of the chlamydia infections lead to preterm labor, pelvic inflammatory disease, and ectopic pregnancy that may lead to subsequent infertility in women (CDC, 2014). In men, however, this infection may lead to epididymitis and Reiter's syndrome (CDC, 2014). Chlamydia-positive mothers may give birth to infants suffering from chlamydia pneumonia and conjunctivitis (Cecere & Jones, 2014).

The gonorrhea infection has also been shown to cause severe health complications when not treated; however, it can be cured when the right medication is employed (Springer & Salen 2022) . The rates of gonorrhea infections have been low over the past decade compared to the 1970s and 80s; however, these rates are steady in some states while they are on an increase in other states (Sheaves, 2012). When not treated in time, women with gonorrhea may suffer from an ectopic pregnancy and pelvic inflammatory disease while in males this infection may lead to epididymitis and infertility. Mothers who are positive for gonorrhea infection may bear infants who are at a greater risk of contracting conjunctivitis, which requires treatment with antibiotics (Sheaves, 2012). African American youth often begin using alcohol and drugs at a young age as well as engage in sexual risk behaviors (Edwards et al., 2017). According to CDC (2015), half of the cases of gonorrhea and chlamydia involve young people aged between 15 and 24. Additionally, the CDC (2015) reported that adolescents aged between 15 and 19 years

were at a greater risk of contracting chlamydia and gonorrhea than any other age category.

Moreover, syphilis is associated with significant complications, particularly among pregnant women (Cha et al., 2017; Kimball et al., 2020; Trivedi et al., 2018). In 2013, the first congenital syphilis case after no cases since 2008 was reported (Cha et al., 2017). Congenital syphilis can cause miscarriage, stillbirth, or early infant death and infected infants can experience lifelong physical and neurologic problems (Kimball et al., 2020). In the United States, the number of reported congenital syphilis cases increased 261% during 2013–2018, from 362 to 1,306 (Kimball et al., 2020).

To effectively treat patients with chlamydia, gonorrhea, and/or syphilis, it is imperative to treat their recent and current sexual partners. This would help in reducing the rates of reinfection as well as ceasing the rapid rate of transmission of the STIs. From the published statistics, 30% of the reported cases of gonorrhea for the study carried out in 2009 showed that the specimens were co-infected with chlamydia (CDC, 2015).

The control and prevention strategies of chlamydia and gonorrhea involve identifying the asymptomatic infections using screening programs and provision of timely treatment to the patients and their sexual partners (Kissinger, 2014). Congenital syphilis is avoidable with the timely screening and treatment of pregnant women (Trivedi et al., 2018). In most parts of the country, the sexual partners of the patients who had chlamydia, gonorrhea, or syphilis were notified of their potential risks of contracting the STIs through the patient Ferreira A, Young T, Mathews Zunza, & Low, 2013). Usually, it is recommended that the patient's partner be given access to medical care for treatment

once the health care provider has been referred. This, however, has presented a significant barrier to some of the partners making it difficult to conduct this practice.

The other approach to this can be achieved by holding an interview with the infected individual to elicit the names of the recent sexual partners. Once this has been done, the health care provider then needs to contact the victims and advise them confidentially about their recent contact with someone with STIs. This is the appropriate time to provide counseling on treatment and employ other testing options. This approach may seem effective; however, it takes the health provider considerably longer time to reach all the possible contacts mentioned by the client. Also, some clients may find it impossible to disclose the identities of their partners. Others may also bear the feeling that their partners may not cooperate for testing and/or treatment because of stigma or lack of concern for the infected individual.

Further, evidence suggests race, gender, and age are associated with different types of STIs (Francisco-Natanauan et al., 2021; Habel et al., 2018; Mitsch et al., 2017). Mitsch et al. (2017) argued to improve individual health and to prevent HIV, outcomes must improve, particularly for female individuals aged between 13 and 34 years. Rose and Friedman (2017) recommended future research for school nurses and sexual health services. Habel et al. (2018) recommended future discussing the benefits of extragenital STD testing for heterosexuals. Francisco-Natanauan et al. (2021) highlighted a need for universal and timely testing to allow the treatment of those infected. Regardless, few attempts have been conducted to examine the relationship between different types of STI

infection, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age among African Americans in the United States.

Problem Statement

The general problem is that STIs such as chlamydia, gonorrhea, and syphilis infection are more prevalent in other demographic categories than others (see Blair et al., 2020; Kularatne et al., 2018). The specific problem I addressed in my study is it remains unclear the relationship between different types of STI infection, specifically chlamydia, gonorrhea, and syphilis, and race, gender, and age among infected individuals in the United States (see Blair et al., 2020; Deziel et al., 2018). The prevalence and occurrence of STIs is particularly high in African Americans (Kularatne et al., 2018). According to statistics, chlamydia, gonorrhea, and syphilis rates are 1.5, 4.5, 1.2 times higher in African American populations than in Whites, respectively (CDC, 2014; McLaughlin & Castrodale, 2020). If left unchecked, these high rates may lead to networks of risky partners within this population that further spread the STIs within the minority group (Pflieger et al., 2013).

Purpose of the Study

The purpose of this quantitative correlational design was to examine the relationship between different types of STI infection, specifically chlamydia, gonorrhea, and syphilis, and race, gender, and age among people in the United States who have or are currently undergoing treatment for chlamydia, gonorrhea, and syphilis. Data were collected using the Colorado Department of Public Health and Environment. Multiple

regression analysis was performed to determine relationships between the number of cases of infected individuals, race age, and sex.

Research Questions and Hypotheses

The following are the research questions and corresponding hypotheses that guided and were addressed in this study.

RQ1: What is the relationship between the number of cases of chlamydia infections and sex, age, and race?

$H_0$1: There is no significant relationship between the number of cases of chlamydia infections and sex, age, and race.

$H_1$1: There is a significant relationship between the number of cases of chlamydia infections and sex, age, and race.

RQ2: What is the relationship between the number of cases of gonorrhea infections and sex, age, and race?

$H_0$2: There is no significant relationship between the number of cases of gonorrhea infections and sex, age, and race.

$H_1$2: There is a significant relationship between the number of cases of gonorrhea infections and sex, age, and race.

RQ3: What is the relationship between the number of cases of syphilis infections and sex, age, and race?

$H_0$3: There is no significant relationship between the number of cases of syphilis infections and sex, age, and race.

$H_1$3: There is a significant relationship between the number of cases of syphilis infections and sex, age, and race.

Theoretical Framework for the Study

The SEM Socio-Ecological Model addresses the complexities or interdependencies between socioeconomic, cultural, political, environmental, organizational, psychological, and biological determinants of behavior (McLeroy et al., 1988). It underscores that while individuals are responsible for maintaining lifestyle changes necessary to reduce risk and improve health, individual behavior is influenced by factors at different levels. Several versions of the SEM use somewhat different classification of these levels. For the study, I used five levels as recommended by McLeroy et al. (1988). The first level is the individual, which includes the characteristics that influence behavior, such as knowledge, attitudes, skills, and beliefs. Level 2 is interpersonal processes, which provide social identity and role definition such as partner, friends, and family. The third level, organizational, includes rules, policies, and formal and informal structures. Level 4 is community with established norms and values, standards, and social networks. The fifth and final level is societal, which includes cultural context and national policies on health (McLeroy et al., 1988).

Nature of the Study

The nature of the study was quantitative. Quantitative research is suited to examining questions of "how many" and to determining relationships between variables (Lee, 2014). The purpose of this study was to determine the relationship between the variables number of STI infection (chlamydia, gonorrhea, and syphilis), age, gender, and

race. By contrast, qualitative research is descriptive, focusing on issues of "why" or "how" (Lee, 2014), and deals with the experiences of individual participants rather than the statistically aggregated experiences of a larger sample. Thus, qualitative research was a poor fit for the purpose of this study.

The specific research design was cross-sectional, nonexperimental, and correlational. Correlational research considers the correlations between variables, using statistical tests to make meaningful statements about these correlational relationships, including statements of correlation, non-correlation, moderation, and mediation (Johnson, 2001). Although correlational designs do not have the ability to make statements of causation, some variables simply cannot be reasonably or ethically manipulated by a researcher, nonexperimental designs require significantly less work to implement than experimental designs, and statements of correlation are still meaningful results for policy and future research. Cross-sectional data can provide a broad picture of a population at a single point in time (Johnson, 2001), and a cross-sectional design is the most suitable to exploring treatment of STIs, which happens over a short period for any given patient. The participants of the study were individuals in the state of Colorado who have or are currently undergoing treatment for chlamydia, gonorrhea, or syphilis infection. I entered enter into a data use agreement with the Colorado Department of Public Health and Environment prior to receiving data.

Definitions

African American: An ethnic group of Americans with total or partial ancestry from any of the Black racial groups of Africa (Lasker et al., 2019).

Chlamydia: A sexually transmitted infection caused by the bacterium Chlamydia trachomatis that can be easily cured. Such infection affects a woman's cervix, or it may affect the urethra of both men and women (Belland et al., 2004).

Gonorrhea: A disease that involves inflammatory discharge from the urethra or vagina (Morgan & Decker, 2016).

Sexually transmitted disease: Diseases that are passed on from one person to another through sexual contact, and sometimes by genital contact - the infection can be passed on via vaginal intercourse, oral sex, and anal sex (Calsyn et al., 2009). However, people who become infected, do not always experience any symptoms or have their infection develop into a disease as such the development of the term sexually transmitted infection (STI).

Sexually transmitted infection: Commonly used term for the collection of medical infections that are transmitted through sexual contact (Calsyn et al., 2009). The term STI, as opposed to sexual transmitted disease (STD), though conceptually similar is broader and more encompassing because some infections are curable and may not cause any symptoms.

Syphilis: A bacterial infection, which is usually spread by sexual contact (Cha et al., 2017). Syphilis is a disease starts as a painless sore, which is typically on genitals, rectum, or mouth (Cha et al., 2017).

Assumptions

In every research, assumptions are inevitable most especially in quantitative studies where the aim is towards making inferences about unknown population

parameters (Cooper & Schindler, 2013). This study involves two main assumptions. First, I assumed the data set provided by the Colorado Department of Public Health and Environment was accurate and complete. Second, I assumed that the patients from whom the information was received resided in the state of Colorado at the time the data was collected by the corporation official.

Scope and Delimitations

Individuals in the state of Colorado who have or are currently undergoing treatment for chlamydia, gonorrhea, or syphilis were the focus and thus defined the scope of this study in terms of participants. Aside from this, there were several delimitations set forth for the study. First, the selection of a correlational research design intrinsically limited the analysis to the significance, behavior, and magnitude of the relationships between variables. Such design did not provide any information regarding the differences of the value of the dependent variables across groups and the causal relationship of variables. Second, the participants were delimited to patients with chlamydia, gonorrhea, or syphilis infection.

Limitations

One of the major challenges that the community health workers face in treating STIs is denial from partners. Most of the medical centers also lack proper strategic plans that can facilitate the transition of the health care from one generation to the next. The significance of health structures is linked to passing the management of the business to the next generation. As such, there is the need for an elaborate plan and policy framework that would guide transition and reduce the possible conflicts and failures that are likely to

arise from the process. Most of the generations lack the experience that is required in the management of the health sector.

Significance

My study may contribute meaningfully to both academic and social problems. Academically, it may help to answer several calls for research in the literature, including those for person-based STI research (Habel et al., 2018; Pflieger et al., 2013), those for more research on sexual partner dyads and their willingness to share STI information (Dillow & Labelle, 2014), those calling for research on public sexual health programs that can meet national needs (Mitsch et al., 2017; Uusküla et al., 2014), and those for how public sexual health programs can increase testing (Francisco-Natanauan et al., 2021; Thomson et al., 2014).

Socially speaking, STIs are a serious problem. Chlamydia results in more cases of female infertility than any other type of infection (ten Hoor et al., 2013), and adolescent STI infections are correlated to greatly increased risk of HIV (Newbern et al., 2013). African Americans have elevated rates of STI incidence (Kularatne et al., 2018; Blair et al., 2020), emphasizing the need for a better understanding of how STIs may be combatted in the context of this study's target population. The results of this study may help in reducing STI incidence and reinfection among African Americans and general population in the United States.

Summary

The general problem was that STIs, chlamydia, gonorrhea, and syphilis infections are more prevalent in some demographic categories than in others (Kularatne et al., 2018;

Blair et al., 2020). The specific problem I addressed was that it remains unclear regarding the relationship between different types of STI infection, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age (see Blair et al., 2020; Deziel et al., 2018). The participants of the study were individuals that currently reside or resided in Colorado who have or are currently undergoing treatment for chlamydia, gonorrhea, or syphilis infection. I used data that provided by Colorado Department of Public Health and Environment. The data sets were analyzed using SPSS. Chapter 2 will focus on literature review for this study.

Chapter 2: Literature Review

The purpose of this quantitative correlational design was to examine the relationship between different types of STI infection, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age among people in the United States who have or are currently undergoing treatment for chlamydia, gonorrhea, and syphilis. Data were collected using the Colorado Department of Public Health and Environment. Two decades ago the Institute of Medicine (IOM) called STDs "hidden epidemics" that are especially invidious because many Americans are resistant to open discussion of sexual health issues, thereby intensifying their human and economic costs (CDC, 2015). Drawing on this report, In 2015 CDC called on public and private organizations, communities, and individuals to work collaboratively to combat sexually transmitted diseases (STDs) and their associated health consequences.

Targets for reducing the prevalence of STDs are embedded in the objectives of *Healthy People 2020,* whose overarching goal is eradicating health disparities, an endeavor that entails tracking disease trends and identifying population groups and diseases for specific interventions (Adekoya et al., 2015; CDC & Indian Health Service, 2014). While incidence rates for some infectious diseases have declined among African American population, many disparities remain, and incidence rates for chlamydia, gonorrhea, and syphilis infections are disproportionately high (Laurencin et al., 2018).

Alarming increases in the incidence of chlamydia, gonorrhea, and syphilis infections in 2009 triggered awareness that existing public health strategies for STD prevention and intervention were clearly ineffective. STIs such as chlamydia, gonorrhea,

and syphilis are more pronounced in some demographics than others (Adekoya et al., 2015). Specifically, these diseases might be more pronounced in African Americans (Blair et al., 2020; Kularatne et al., 2018).

The purpose of this quantitative correlational design was to examine the relationship between different types of STI infection, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age among people in the United States who have or are currently undergoing treatment for chlamydia, gonorrhea, and syphilis in the state of Colorado. McLeroy et al.'s (1988) SEM theory was the underpinning of the present study. Young African Americans are aware of the negative impact of STDs in their communities and are eager for accurate information on sexual health (Stevens et al., 2017). The most effective prevention and health promotion programs for African American population are designed with input from the target group and integrate tribal culture and values into health-related best practices (de Ravello et al., 2014). *Healthy People 2020* recognized the importance of culture in addressing health disparities (Adekoya, 2015; CDC & Indian Health Service, 2014).

Literature Search Strategy

The literature presented in this review was drawn from PubMed, MEDLINE, and the following EBSCO databases: Academic Search Premier, MasterFILE Premier, PsycINFO, and PsycARTICLES. Keywords used either individually or in conjunction included *sexually transmitted diseases (STDs), sexually transmitted infections (STIs), chlamydia, gonorrhea, syphilis, infection, patient-delivered partner therapy (PDPT), partner notification, partner services, partner treatment, African Americans, Native*

Americans, intervention, programs, culture, stigma, motivation, behavior change, resistance, and *reactance theory*. Over 75% of the studies were published between 2017 and 2021.

The organization of the review is as follows: (a) theoretical foundation, (b) definition of STDs and STIs, (c) chlamydia prevalence, (d) gonorrhea prevalence, (e) syphilis prevalence, (f) chlamydia, gonorrhea, and syphilis in African Americans, (g) race, gender, age, and STIs, (h) STD prevention and treatment, (i) partner services for STD treatment, (j) partner notification, (k) research reviews and modeling, and (l) sexual health education for African American youth. The review will end with a conclusion.

Theoretical Foundation

The study was based on social ecological model (SEM). The SEM is a more comprehensive model because it comprises several factors from individual level to the environment and includes the policies and laws targeting affect health and access to health services (McLeroy et al., 1988). The SEM helps scholars and researchers to establish the intertwined link between various levels. The SEM can be used to address the complexities and interdependence between the environments and policies incorporating social and psychological influence on the behavior (McLeroy et al., 1988). SEM model has major factors that influence health behaviors among people: (a) intrapersonal/individual factors, which influence behavior such as knowledge, attitudes, beliefs, and personality; (b) interpersonal factors, such as interactions with other people, can provide social support or create barriers to interpersonal growth that promote healthy behavior (; (c) institutional and organizational factors, including the rules, regulations,

policies, and informal structures that constrain or promote healthy behaviors; (d) community factors, such as formal or informal social norms that exist among individuals, groups, or organizations, can limit or enhance healthy behaviors; and (e) public policy factors, including local, state, and federal policies and laws that regulate or support health actions and practices for disease prevention including early detection, control, and management (McLeroy et al., 1988). Using the above constructs, I used the SEM model to understand how the convergence of factors in the social environment, including poverty, race and ethnicity, and gender, work together to increase incidences of gonorrhea, and chlamydia, syphilis.

Definition of STDs and STIs

According to American Sexual Health Association (ASHA,2016), STDs are diseases that are spread through sexual contact. However, many experts in sexual health and health have suggested in replacing STD with a newer term --- STI. Experts advocate to use the new term for several reasons. The concept of a disease suggests the existence of a medical problem with obvious signs or symptoms. Yet in practice, most of the common STDs have no obvious signs or symptoms or those infected might only have mild signs and symptoms. Experts argued that the sexually transmitted virus or bacteria can be described as one that creates an infection of the body but does not necessarily result into a disease. Some examples of these STDs are herpes, chlamydia, human papillomavirus, and gonorrhea. Some professionals and organizations have begun using infection or STIs rather than diseases or STDs. ASHA (2016) has been using the term

STD since 1988; however, it is more likely that individuals and organizations will use STI more often.

Chesson et al. (2021) estimated the lifetime medical costs attributable to STIs acquired in 2018, including sexually acquired HIV Chesson et al. found incident STIs in 2018 imposed an estimated $15.9 billion in discounted, lifetime direct medical costs. The results of Chesson et al. also indicated most of this cost was due to sexually acquired HIV and human papillomavirus (HPV), which amounted $13.7 billion and $0.8 billion, respectively. Moreover, Chesson et al. found STIs in women accounted for about one fourth of the cost of incident STIs when including HIV, while about three fourths when excluding HIV. The results indicated STIs among 15- to 24-year-olds accounted for $4.2 billion of the cost of incident STIs. Chesson et al. suggested incident STIs continued to impose a considerable lifetime medical cost burden in the United States.

Chlamydia Prevalence

Despite major efforts to control their spread and specific guidelines for infection prevention as well as treatment and follow-up, reported STIs are increasing (Batteiger et al., 2019; Lochner & Maraqa, 2018). Chlamydia, gonorrhea, and syphilis continue to be significant burdens to the health of pregnant women and their children despite there being easy and effective guidance for screening and treatment (Lochner & Maraqa, 2018). Chlamydia, gonorrhea, and syphilis were the focus of this study as they are prevalent in African American Americans and general population in Colorado.

Chlamydia is the most common STD in the United States and since 1994 has accounted for the largest proportion of STDs reported to the CDC (CDC, 2015). In 2014,

1,441,789 cases of chlamydia were reported to the CDC, representing an increase of 2.8% from 2013. While this marked the first increase since the inception of nationwide reporting, to some extent it may signify increases in screening and reporting. Widespread screening, more sensitive diagnostic techniques, and more diligent surveillance underpin increases in chlamydia rates across all population groups over the last 2 decades, but do not account for persistent disparities between groups (CDC & IHS, 2014).

A substantial increase in the reported incidence of chlamydia among men, which rose by 22% from 2010 to 2014, compared to a 6% for women during this time frame, is attributed to the greater availability of urine testing for chlamydia infection, resulting in more men being tested (CDC, 2015). Nonetheless, the rate of chlamydia among women in 2014 was more than twice as high as the rate for men. Chlamydia is especially prevalent in young women. In most cases women who have been infected are asymptomatic, but an insidious aspect of the infection is that untreated chlamydia can result in pelvic inflammatory disease (PID), which is a key cause of infertility, chronic pelvic plain, and ectopic pregnancy (CDC, 2015). Given that young women from 15 to 19 have the highest incidence of chlamydia infection, followed by women from 20 to 24, universal screening is recommended for sexually active women in those age groups, as well as for pregnant women and for women over age 24 who are at heightened risk of infection (Mishori et al., 2012). Despite the widespread adoption of chlamydia screening, the CDC (2015) cautioned that many women at risk for infection are not being tested, often due to health providers' lack of awareness and limited resources to support the expansion of screening.

Gonorrhea Prevalence

Gonorrhea is the second most reported STD in the United States (CDC, 2015). Nationally, the rate of reported cases of gonorrhea was historically low in 2009, with 98.1 cases reported per 100,000 people (CDC, 2015). However, the national rate has been fluctuating from 2009 onward, with a slight increase from 2009 to 2012, a decline in 2013, and an increase in 2014, from 105.3 cases per 100,000 people in 2013 to 110.7 cases per 100,000 people in 2014. Like gonorrhea in women , it is often asymptomatic and untreated gonococcal infections produce similar complications (Mayor et al., 2012). In contrast, most men with gonorrhea are symptomatic, though roughly 10% of cases in men are asymptomatic. In terms of age, young men and women from 20 to 24 have the highest incidence of gonorrhea (CDC, 2015). There are two major concerns specific to gonorrhea. First, gonococcal infection can promote the transmission of HIV. Second, the development of antimicrobial resistance in relation to treatment (CDC, 2015; Workowski & Bolan, 2015).

Syphilis Prevalence

Syphilis is associated with significant complications, particularly among pregnant women (Trivedi et al., 2018). Prenatal screening and treatment for STIs can prevent adverse perinatal outcomes (Cha et al., 2017). In Guam, the largest of the three U.S. territories in the Pacific, primary and secondary syphilis rates among women increased 473%, from 1.1 to 6.3 per 100,000 during 2009–2013 (Cha et al., 2017).

In 2013, the first congenital syphilis case since 2008 was reported (Cha et al., 2017). Congenital syphilis is an infection with treponema pallidum in an infant or fetus,

acquired during pregnancy from a mother with untreated or inadequately treated syphilis (Kimball et al., 2020). Congenital syphilis can cause miscarriage, stillbirth, or early infant death, and infected infants can experience lifelong physical and neurologic problems (Kimball et al., 2020; Trivedi et al., 2018). Although timely identification and treatment of maternal syphilis during pregnancy can prevent congenital syphilis, the number of reported congenital syphilis cases in the United States increased 261% during 2013–2018, from 362 to 1,306 (Kimball et al., 2020).

Congenital syphilis is avoidable with the timely screening and treatment of pregnant women (Trivedi et al., 2018). Congenital syphilis prevention involves syphilis prevention for women and their partners and timely identification and treatment of pregnant women with syphilis (Kimball et al., 2020). Congenital syphilis prevention strategies that implement tailored public health and health care interventions to address missed opportunities can have substantial public health impact (Kimball et al., 2020).

Kimball et al. (2020) found that among reported congenital syphilis cases during 2018, 94 resulted in stillbirths or early infant deaths. Using 2018 national congenital syphilis surveillance data and a previously developed framework, CDC identified missed opportunities for congenital syphilis prevention (Kimball et al., 2020). Kimball et al. indicated the most missed prevention opportunities were a lack of adequate maternal treatment despite the timely diagnosis of syphilis (30.7%) and a lack of timely prenatal care (28.2%), with variation by geographic region.

Cha et al. (2017) evaluated the prevalence of screening for syphilis, HIV, chlamydia, and gonorrhea. Cha et al. also examined correlates of inadequate screening

among pregnant women in Guam. With data from the medical records of a randomly selected sample of mothers with live births in 2014 at a large public hospital, Cha et al. conducted bivariate analyses and multivariable models using regression to determine the factors associated with inadequate screening for syphilis and other STIs. The analysis of Cha et al. (2017) revealed 26.8% of women were not screened sufficiently early to prevent adverse pregnancy outcomes. Cha et al. also found 31.1% of women were not screened for HIV infection, 25.3% were not screened for chlamydia, and 25.7% not screened for gonorrhea.

Trivedi et al. (2018) analyzed national case report data for 2012–2016 to assess trends among pregnant women with all stages of syphilis. Trivedi et al. also evaluated reported behavioral risk factors for syphilis. The results of Trivedi et al. (2018) revealed during 2012–2016, the number of syphilis cases among pregnant women increased 61%, from 1,561 to 2,508. Congenital syphilis cases increased 88% from 334 to 628, and syphilitic stillbirths increased 173%, from 15 to 41 (Trivedi et al., 2018). Trivedi et al. also found the largest increases among pregnant women were in the West (292%) and among American Indians/Alaska Natives (420%), non-Hispanic Whites (108%), and Hispanics (92%). Moreover, Trivedi et al. found most cases were reported in the South (56%) and among non-Hispanic Black women (48%). The results also indicated many pregnant women with syphilis denied any risk factors.

The results of Cha et al. (2017) suggested prenatal care and insurance were important factors affecting STI screening during pregnancy. Cha et al. also suggested prenatal care providers played an important role in preventing congenital infections. The

results of Trivedi et al. (2018) suggested congenital syphilis and syphilis cases among pregnant women were steadily increasing.

Lochner and Maraqa (2018) reviewed the epidemiology of chlamydia, gonorrhea, and syphilis. Lochner and Maraqa also reviewed testing methodology as molecular-based techniques, which had replaced culture as the gold standard tests of choice for chlamydia and gonorrhea. The review process conducted revealed the nontreponemal and treponemal serologic diagnostic and screening approach to syphilis had undergone less change. Specifically, treatment for gonorrhea includes a one-time dose of parenteral ceftriaxone and oral azithromycin, and Lochner and Maraqa found this treatment regimen addressed the possible gonococcal resistance seen in recent years. Lochner and Maraqa also provided evidence this treatment regimen also treated chlamydia, which might present similarly or co-infect the same patient. The findings of Lochner and Maraqa (2018) indicated syphilis treatment in both pregnant women and their infected neonates remained with penicillin G formulations. Which could address the issue of continued infection and timely treatment.

Gregory and Ely (2020) presented data on recent trends for three STIs, including chlamydia, gonorrhea, and syphilis, which were reported among women giving birth in the United States from 2016 through 2018. Gregory and Ely also presented the rates by selected characteristics for 2018. Using the data from birth certificates were based on 100% of births registered in the United States for 2016, 2017, and 2018, Gregory and Ely found mothers had an infection if there was a confirmed diagnosis or documented treatment for the infection in their medical record. The results of Gregory and Ely

revealed among women giving birth in 2018, the overall rates of chlamydia, gonorrhea, and syphilis were 1,843.9,310.2 and 116.7 per 100,000 births, respectively. Gregory and Ely also found the rates for these STIs increased, specially a 2% increase in chlamydia, 16% in gonorrhea, and 34% in syphilis from 2016 through 2018. The results also revealed in 2018, rates of chlamydia and gonorrhea decreased with advancing maternal age, whereas those for syphilis decreased with maternal age through 30–34 years and then increased for women aged 35 and over. Gregory and Ely further found evidence that in 2018, rates of all three STIs were highest for non-Hispanic Black women, women who smoked during pregnancy, women who received late or no prenatal care, and women for whom Medicaid was the principal source of payment for the delivery. Further, the results indicated among women aged 25 and over, rates of each of the STIs decreased with increasing maternal education (Gregory & Ely, 2020).

Building on successful models for emergency department HIV screening, a routine opt-out syphilis screening program in a large, urban, tertiary care hospital emergency department was implemented in May 2019 (Stanford et al., 2021). Stanford et al. (2021) assessed the prevalence of syphilis in this population and evaluated the routine, opt-out syphilis screening model. Stanford et al. performed a retrospective chart review of all patients screened for syphilis in the emergency departments from June to December 2019. Stanford et al. examined demographic information, HIV status, chief complaint, and follow-up visits. The results of Stanford et al. (2021) revealed during the study period, 9198 people aged 18 to 64 years were screened for syphilis. Of these, 1.1% had presumed active syphilis infection, 3.8% were presumed not to have active syphilis, and

95.1% were negative for infection. Stanford et al. found patients with presumed active syphilis infection were more likely to be male, although the percentage of women was considerably higher than the nationally reported rate, and most were non-Hispanic Black. The results indicated among patients with presumed active syphilis infection, 23.7% were HIV positive, while only 18.6% of patients with presumed active syphilis infection presented with complaints related to sexually transmitted infections.

Lochner and Maraqa (2018) suggested it would be crucial to establish close follow-up evaluation for the pregnant woman infected with these sexually transmitted infections to ensure adequate treatment and help prevent perinatal spread of the infection. The results of Stanford et al. (2021) suggested syphilis rates in the community were very high, and many infections were found in populations traditionally considered at lower risk by demographic or presenting complaint.

Cha et al. (2017) highlighted policies and programs increasing STI and HIV services for pregnant women and improved access to and use of prenatal care were essential for promoting healthy mothers and infants. Trivedi et al. (2018) argued it would be essential that practitioners adhere to CDC recommendations to screen all pregnant women for syphilis at the first prenatal visit. Trivedi et al. also highlighted CDC recommended repeat screening based on risk factors and geography. Trivedi et al. further emphasized that patient-reported risk factors might not sufficiently identify all those at risk for syphilis in pregnancy. Stanford et al. (2021) proposed universal screening was needed. Stanford et al. also argued routine emergency departments syphilis screening in high-prevalence communities would be critical to addressing the syphilis epidemic.

Stanford et al. (2021) argued with syphilis rates rising rapidly in the United States, novel means of reaching high-risk populations for screening and treatment were needed.

Chlamydia, Gonorrhea, and Syphilis in African Americans

Using incidence data from the Center for Disease Control, Marotta (2017) conducted Moran's I analyses to assess the data for statistically significant clusters of chlamydia and gonorrhea at the county level in 46 states of the United States. Marotta used Lagrange multiplier diagnostics to justify selection of the spatial Durbin regression model for chlamydia and the spatial error model for gonorrhea. The results of Marotta (2017) revealed rates of chlamydia and gonorrhea were highly clustered particularly in the southern region of the United States. The logged percent in poverty and racial composition of African Americans, native Americans, and Asians were significantly associated with greater rates of chlamydia and gonorrhea, respectively, after accounting for spatial dependence in the data. Marotta also found logged rates of rates violent crimes were associated with chlamydia and gonorrhea, while logged rates of drug crimes were only associated with chlamydia, and metropolitan census designation was associated with logged rates of chlamydia and gonorrhea.

Kularatne et al. (2018) estimated the trends in prevalence and incidence of syphilis, gonorrhea, and chlamydia in adult men and women in South Africa. Employing the Spectrum-STI tool, Kularatne et al. used programmatic surveillance data to estimate trends in incident gonorrhea cases resistant to first-line treatment, and the reporting gap of symptomatic male gonorrhea and chlamydia cases treated but not reported as cases of urethritis syndrome. The results of Kularatne et al. (2018) revealed in 2017, adults

between 15 and 49 years, their estimated female and male prevalence for syphilis were 0.50% and 0.97%, for gonorrhea 6.6% and 3.5%, and for chlamydia 14.7% and 6.0%, respectively. The results indicated between 1990 and 2017, the estimated prevalence of syphilis declined steadily in women and men, probably in part reflecting improved treatment coverage. For gonorrhea and chlamydia, Kularatne et al. found the estimated prevalence and incidence showed no consistent time trend in either women or men. Kularatne et al. also found despite growing annual numbers of gonorrhea cases, the estimated number of first line treatment-resistant gonorrhea cases did not increase between 2008 and 2017, owing to changes in first-line antimicrobial treatment regimens for gonorrhea in 2008 and 2014/5. Kularatne et al. estimated case reporting completeness among treated male urethritis syndrome episodes was at 10–28% in 2017.

Blair et al. (2020) conducted an observational analysis of a longitudinal cohort of predominantly Black/Latino men who have sex with men (MSM) in Los Angeles. Every six months from August 2014 to January 2018, Blair et al. invited the participants to complete STI screening and surveys evaluating lubricant use, douching, substance use, and sexual risk behaviors. Employing general estimating equations, Blair et al. evaluated the association between consistent lubricant use and douching for RAI with positive rectal Neisseria gonorrhoeae, Chlamydia trachomatis, and/or syphilis (positive STI). The results of Blair et al. (2020) revealed among 313 participants across 552 study visits, 16.5% had positive STI. Blair et al. found consistent lubricant use was reported in 52.7% and rectal douching in 57.6% of study visits. The results indicated consistent lubricant

use was associated with STI diagnosis, and each episode of rectal douching before RAI was associated with 2% increased odds of positive STI.

Marotta (2017) suggested spatial heterogeneity in the distribution of rates of chlamydia and gonorrhea provided important insights for strategic public health interventions in the United States. Marotta also informed the allocation of limited resources for the prevention of chlamydia and gonorrhea. Kularatne et al. (2018) suggested South Africa continued to suffer a high STI burden. The results of Kularatne et al. (2018) also suggested improvements in access and quality of maternal, STI, and HIV health care services likely contributed to the decline in syphilis prevalence. The results of Blair et al. (2020) suggested among the African American cohort of HIV-positive and high-risk HIV-negative MSM, lubricant use and douching was common and independently associated with an STI. The results of Blair et al. also suggested the utility of prevention messaging around barrier methods/condoms for sexual encounters involving douching/lubricant use.

Race, Gender, Age, and STIs

Mitsch et al. (2017) measured linkage to care, retention in care, and suppressed viral load (VL) among individuals in the United States aged above 13 years with diagnosed HIV infection. Using national HIV case surveillance data to measure linkage to care, Mitsch et al. found in 2013, 74.1% of the participants were linked to care. The results of Mitsch et al. (2017) also revealed at year-end 2012, 46.9% of the participants were retained in care and 45.1% were virally suppressed. Mitsch et al. also found a lower percentage of females (41.3%), compared with males (46.5), were virally suppressed. The

results of Mitsch et al. further indicated by age group, the lowest percentage of virally suppressed participants were aged 13–34 years.

Habel et al. (2018) examined the prevalence and correlates of heterosexual anal and oral sex, associated condom use, and having multiple partners among men and women aged 15 to 44 years. The results of Habel et al. (2018) revealed approximately one third of women and men had ever engaged in anal sex, including 11% of adolescents that were between 15 and 19 years. Habel et al. found most women and men had ever received or given oral sex. The results of Habel et al. also revealed 6% and 7% of women and men, respectively, used a condom at last oral sex compared with 20% and 30% who used a condom at last anal sex. Habel et al. further found having multiple sex partners in the past year was most common among adolescents, never or formerly married persons, and those who had a nonmonogamous partner. The results indicated a substantial minority had multiple oral or anal sex partners, and Black women and men had the highest reports of oral sex partners by race/ethnicity.

Using data from a mid-sized Midwest metropolitan area, Batteiger et al. (2019) examined the settings in which individuals were tested for gonorrhea and chlamydia in relation to demographics. Batteiger et al. also tested result to determine where interventions might best be focused. Creating a deidentified and integrated registry, containing records from all patients tested for an STI from 2003 to 2014, Batteiger et al. performed and analyzed individual characteristics and visit settings. The results of Batteiger et al. (2019) revealed females were tested significantly more often than males and received testing more often in outpatient clinics whereas males were most often

tested in the STI clinic. Batteiger et al. also found individuals who used both STI and non-STI settings were more likely to have a positive test at an STI or emergency department visit than outpatient or inpatient setting. The results of Batteiger et al. also indicated test visits increased over the study period, particularly in emergency departments, which showed a substantial increase in the number of positive test visits.

The results of Habel et al. (2018) suggested tailored messaging regarding risk for STD and human immunodeficiency virus acquisition during oral and anal sex might benefit adolescents, singles, and divorced individuals. Batteiger et al. (2019) suggested the most frequent testing sites remained STI clinics for men and outpatient clinics for women. Batteiger et al. also suggested emergency departments were increasingly a source of testing and morbidity, which made them a valuable target for public health interventions that could improve care and population health.

Hepatitis C virus testing rates vary by race/ethnicity in the general population (Li et al., 2021). Li et al. (2021) analyzed medical records data from MSM in the HIV Outpatient Study at nine HIV clinics from January 1, 2011, through December 31, 2019. Excluding observation time after documented past or current HCV infection, Li et al. evaluated HCV antibody testing in each calendar year among HCV-seronegative MSM. Li et al. also assessed testing correlates by generalized estimating equation analyses. The results of Li et al. (2021) revealed of 1,829 eligible MSM who were PWH, 64.2% were non-Hispanic/Latino white, 22.0% non-Hispanic Black, 10.2% Hispanic/Latino, and 3.6% of other race/ethnicity. Li et al. found 68.9% were over 40 years old, 64.5% privately insured with CD4 cell count/mm3, and with HIV viral load of lower than 200

copies/mL. Li et al. also found during 2011–2019, 65.9% had greater than one HCV antibody test and average annual HCV percentage tested was 30.3%. The results of Li et al. (2021) indicated multivariable factors positively associated with HCV testing, including more recent HIV diagnosis, public insurance, lower CD4, prior chlamydia, gonorrhea, syphilis, or hepatitis B virus diagnoses.

An especially high-risk group includes adolescents in juvenile or prisons (Francisco-Natanauan et al., 2021). Francisco-Natanauan et al. (2021) conducted retrospective analysis at the only juvenile detention facility in the State of Hawai'i from 2014 to 2017. Francisco-Natanauan et al. offered adolescents aged 12–17 years STI screening and/or presumptive treatment at the time of medical evaluation. The results of Francisco-Natanauan et al. (2021) revealed of 2,208 adolescents offered voluntary testing, 461 males and 372 females agreed to be tested for Chlamydia trachomatis and Neisseria Gonorrhea. Francisco-Natanauan et al. found acceptance did not vary by age. Francisco-Natanauan et al. also found females chose testing more often than males, and females were also more likely to accept presumptive treatment. In tested youth, the results of Francisco-Natanauan et al. (2021) indicated STIs were prevalent in 24% of females and 10% of males, and before leaving the detention facility, only half the STIs in females and only 39% of male STI infections had been treated.

The results of Li et al. (2021) suggested suboptimal uptake of recommended HCV testing among MSM in HIV care, despite no disparities by race/ethnicity in HCV testing. Francisco-Natanauan et al. (2021) suggested a high prevalence of STIs in both males and

females admitted to this juvenile detention facility, with fewer than half the documented infections being treated before discharge.

Mitsch et al. (2017) argued to improve individual health and to prevent HIV, outcomes must improve. Mitsch et al. (2017) proposed screening for HIV infection in accordance with CDC's testing recommendations, which could lead to improvements along the continuum of HIV care. Habel et al. (2018) recommended future discussing the benefits of extragenital STD testing for heterosexuals. Francisco-Natanauan et al. (2021) highlighted a need for universal and timely testing to allow the treatment of those infected. Francisco-Natanauan et al. also argued if for whatever reason rapid testing could not be obtained, presumptive treatment offered a pragmatic approach to treatment and infection control.

STD Prevention and Treatment

STDs can be prevented and treated if individuals follow some strategies. CDC provided some guidelines for the prevention and control of STDs are based on five key strategies: (1) accurate risk assessment and education and counseling of individuals at risk on how to avoid STDs through changes in sexual behaviors and utilization of recommended prevention services; (2) pre-exposure vaccination of individuals at risk for vaccine-preventable STDs; (3) identification of asymptomatic and symptomatic infected persons; (4) effective diagnosis, treatment, counseling, and follow-up of infected persons; and (5) evaluation, treatment, and counseling of sexual partners of persons infected with an STD (Workowski & Bolan, 2015). Comprehensive STD/HIV risk assessment

encompasses the “Five P’s”: Partners, Practices, Prevention of Pregnancy, Protection from STDs, and Past History of STDs.

One of the ways to reduce the risk of STDs is to practice safe sex and to take the screening test from time to time. The most effective ways of preventing or significantly reducing the risk of STD infection is abstinence (Chin et al., 2012; Gallo et al., 2016; Long-Middleton et al., 2013), being in a long-term, mutually monogamous relationship, and consistent condom use (Campbell et al., 2013; Chambers et al., 2016; Duff et al., 2015; Jemmott et al., 2014; Mishori et al., 2012). As previously stated, routine screening for chlamydia is recommended for all sexually active young women and due to increasing availability of urine testing, is becoming more common for men (CDC, 2015). Despite concerns of potential allergic or adverse reactions to medication by a partner in PDPT, the risk of serious adverse reactions to azithromycin is actually very low and significant side effects are unusual (Stidham et al., 2015).

One reason for the importance of timely treatment for STDs is the potential for complications. As illustrated by the high proportion of asymptomatic chlamydia infection, most infections clear over time and the risk for complications is small in women and men. However, that does not downgrade the significance of serious complications that may result from untreated chlamydia (Mishori et al., 2012).

Repeated chlamydia infection is a common phenomenon among young sexually active women (Batteiger et al., 2010). In a study of high-risk adolescent women (aged 14 to 17), examination and screening at three-month intervals and a documented treatment rate of nearly 98% were not sufficient for protecting against recurring infection. Although

some cases were due to treatment failure, Batteiger et al. noted that most repeated infections resulted from reinfection. Notably, they concluded that effective interventions for sexual partners or relevant sexual networks were essential for reducing the prevalence of chlamydia infection in high-risk population groups.

Screening and partner notification is one of the ways to reduce chlamydia infection and prevalence. Kretzchmar, Satterwhite, Leichliter, and Berman (2012) created a stochastic simulation model to portray the impact of screening and partner notification on chlamydia prevalence in the United States. Based on their analysis, Kretzchmar et al. concluded that expanding the rates of partner notification and treatment would have a potentially greater impact on chlamydia prevalence than increasing screening for women. In particular, partner notification reduces the reinfection rate thus making it a more targeted strategy. To further support their conclusion, Kretzchmar et al. cited a study based on deterministic modeling which demonstrated that the effectiveness of screening is enhanced by the prevention of reinfection between partners. Batteiger et al. (2010) reached essentially the same conclusion from their study of adolescent women.

Compared to chlamydia, which has high rates of prevalence across population groups, gonorrhea tends to be more concentrated in particular geographic locations and communities (Workowski & Bolan, 2015). In many affected communities, health care providers work in collaboration with local public health authorities to identify high-risk groups and target prevention and intervention campaigns (Workowski & Bolan, 2015). Annual screening is recommended for all sexually active women under age 25, older women at increased risk for gonococcal infection, and certain subgroups of MSM.

The partners of patients diagnosed with gonorrhea should be treated within 60 days of potential exposure (Mayor et al., 2012; Workowski & Bolan, 2015). The recommended treatment for uncomplicated gonorrhea in the United States is dual therapy with ceftriaxone and azithromycin. Retesting three months after treatment is recommended. Partner management to prevent reinfection is an essential component of treatment for chlamydia, gonorrhea, and syphilis.

Partner Services for STD Treatment

Partner services is one of the methods for STD treatment. The term *partner services* covers "a continuum of clinical evaluation, counseling, diagnostic testing, and treatment designed to increase the number of infected persons brought to treatment and to disrupt transmission networks" (Workowski & Bolan, 2015). This continuum encompasses actions undertaken by multiple stakeholders including health departments, health care providers, and patients. Health professionals provide partner services by counseling the infected patients and providing them with written information to give to their partners (Hightow-Weidman et al., 2014; Hoots et al., 2014). Clinicians are called on to encourage all patients diagnosed with STDs to notify their partners. The ideal situation is for the partners to see a clinician for medical testing and treatment. The overriding aim of partner services is to prevent reinfection and further transmission of STDs.

Partner Notification

Treating the partners of patients infected with STDs has been a key component of STD treatment since the 1940s. The original term *contract tracing* has been replaced by

partner notification, defined by UNAIDS as "a process that includes informing sexual partners of infected people of their exposure, administering presumptive treatment, and providing advice about the prevention of future infection" (UNAIDS, as cited in Ferreira et al., 2013, p. 7). There are several strategies for partner notification (Kerani, Fleming, & Golden, 2013; Mathews et al., 2015; Morris et al., 2014; Reed et al., 2015).

Patient Referral

Patient referral or *simple patient referral* denotes the strategy by which health professionals encourage the index patient to notify their sexual partner(s) by advising them of the importance of having their partners seek treatment. On the continuum of partner services simple patient referral is considered the minimum standard. Patient referral arose in the 1970s in response to soaring rates of gonorrhea, which exceeded the capacity of specialist partner notification personnel. Patient referral is currently the preferred mode of partner notification for chlamydia and gonorrhea infection in many countries. Most patients prefer to notify their own partners, and in non-specialist settings, it is often the only available option (Ward & Bell, 2014).

Enhanced patient referral refers to various strategies that augment the clinician's spoken advice with the goal of improving the success of patient referral (Bell & Potterat, 2011; Ferreira et al., 2013; Ward & Bell, 2014). Educational material such as written information sheets, videos, home sampling kits for partners, disease-specific websites, counseling, and telephone reminders are all examples of enhanced patient referral techniques. Home sampling has been found to reduce reinfection rates by expediting the testing of the partners of infected patients (Falk, Hegle, Wilson, & Wirehn, 2014).

Online partner notification programs, email, and text messages have recently emerged as alternatives to conventional modes of communication, but responses have been mixed (Hogben et al., 2016; Hopkins et al., 2010; Pellowski et al., 2016; Wohlfeiler et al., 2013).

The attitude of individuals towards partner notification is also important on whether this method will be successful or not. To explore peoples' attitudes toward the use of various modes of communication for partner notification, Hopkins et al. (2010) conducted telephone interviews with 40 Australian adults (25 women and 15 men) who had recently been diagnosed with chlamydia. Rather than welcoming use of newer—and more impersonal—technologies, the participants overwhelming opted to notify their partners in person or by phone. Those who chose to talk to their partners in person felt it was the most respectful, considerate, and caring way to approach such a sensitive topic. There is almost universal agreement that face-to-face communication was the "gold standard" for partner notification. On the negative side, most participants conceded that they felt "nervous, awkward, and embarrassed" (p. 3). For participants who contacted their partner by phone the main reasons were speed and convenience (Hopkins et al., 2010). Email was generally viewed unfavorably and primarily used to contact partners who were out of the country or otherwise geographically distant. Text messages elicited the least positive attitudes. A few participants felt SMS was acceptable for informing a partner with whom they had a brief, superficial relationship such as a one-night stand, but most participants described messaging as "cold," "impersonal," and "rude," and felt they would react badly if they were the recipients. One concern about email, text, or letters

(which were viewed as acceptable) was the notion that privacy could be violated, and the messages could be read by others.

Indirectly, the findings of Hopkins et al. (2010) provide support for the use of enhanced patient referral. The overwhelming preference face-to-face dialogue, which at the same time induces negative emotions, highlights the need for providing patients with counseling or guidance on communication techniques. For individuals who prefer more impersonal modes of communication, Hopkins et al. (2010) recommends providing patients with access to templates that can be used either personally or anonymously for emails, text messages, and letters.

The Denver residents in the study of the Colorado in SPOT online STD partner notification program expressed similar preferences for face-to-face communication over the online program to notify partners of an STD. Beyond an initial surge of interest in the novel program offered to patients of a large urban STI clinic, site statistics revealed that even with clinic-based interventions and a local campaign to encourage use of the website, traffic was low. More than 90% of survey respondents said they would prefer to talk to a partner in person; only 5% said they would use email or the Internet.

Studies of more conventional enhanced patient referral strategies have produced positive results. New York City relies on patient referral for partner notification of chlamydia, gonorrhea, and syphilis infections. In a randomized trial of enhanced patient referral, patients treated at two STI clinics in Brooklyn were randomized to a standard care group or an intervention group that received counseling at the time of diagnosis augmented by follow-up contact. The intervention was based on social cognitive theory

and the theory of reasoned action, both widely used in health psychology, and included communication and behavior change skills training as well as education on STIs. Partner notification was high for both the intervention and the control group but higher for intervention participants (92% versus 86%), who were also more likely to use condoms regularly at the follow-up (48% versus 38%). At the follow-up, 6% of the intervention participants had been reinfected, compared to 11% of the control group. The intervention seemed to be most effective for men. A notable feature of the intervention is that it was culturally tailored for the participants, who were 40% African American and 52% African Caribbean.

Provider Referral

Provider referral denotes the use of third parties, generally specialist health service personnel, to notify partners of infected persons (Ferreira et al., 2013). The title varies according to country; for example, in the United States, these health professionals are called "disease intervention specialists" and in the U.K., they are known as "health advisors." Provider referral was first used in the U.K. and Scandinavia to trace and refer the sexual partners of people with syphilis, which continues to be the main context for provider referral. Recently, provider referral has been used to stem the transmission of HIV and hepatitis B. Provider referral can only be utilized with the explicit consent of the index patient.

Provider referral is the most effective partner notification technique, but it is also the most expensive (Rahman, Khan, & Gruber, 2015; Taylor, 2013). As a result, it is rarely included in chlamydia, gonorrhea, or syphilis intervention programs, although it is

sometimes when the index patient is unable to or refuses to notify partners. Based on evidence that provider referral is very effective for increasing the proportion of partners who receive treatment, Rahman et al. (2015) examined the cost-effectiveness of a telephone-based partner tracing and notification program involving patients from two public STI clinics in Louisiana who had been diagnosed with gonorrhea or chlamydia. The carefully targeted telephone-based program proved to be cost-effective in relation to the potential consequences of continued disease transmission.

Contract Referral.

A fourth option for partner notification is *contract referral,* which centers on an agreement or contract between the index patient and the health care professional (Ferreira et al., 2013). The provider encourages the patient to personally notify partners but the contract stipulates that any partners who do not visit the clinic by a specific date will be notified by the staff. Contract referral may be viewed as something of a hybrid between patient referral and provider referral. It does not seem to be a common approach to partner notification in the U.S., but it may be preferred by individual patients and health professionals.

Research Reviews and Modeling

Apart from clinical trials, there seem to be few protocols for partner notification. As Bell and Potterat (2011) observe, approaches to partner notification vary tremendously between settings, ranging from brief advice to complex, multifaceted interventions. They point out that “Intensive approaches are, unsurprisingly, correspondingly more effective” (p. ii34). Research reviews, meta-analyses, and

modeling have all been applied to investigation of the most effective strategies for STD prevention and control.

Partner notification is not meant to be a standalone strategy but rather part of a comprehensive effort to treat and prevent further transmission of STIs. Alam et al. (2010) and Kissinger (2014) both emphasize that a program must be adapted to the particular setting. The experience of being diagnosed with an STI and the prospect of informing partners elicits a vast range of emotions, including many that are negative (Taylor, 2013; Temkin et al., 2011; Theunissen et al., 2014).

The feasibility of partner notification in developing countries is still unexamined. Alam et al. (2010) conducted a comprehensive review of research on partner notification in some developing countries. However, their findings may be equally applicable to working with cultural minorities in the United States and in communities where access to health care is limited. A total of 39 articles met their inclusion criteria. Counseling the index patient on partner notification emerged as an effective strategy for boosting partner referral in several studies. According to Alam et al., counseling is a practical approach in areas where resources are limited for four major reasons. First, counseling the patient places far fewer demands on human and financial resources than provider referral. Second, the patients expressed highly positive attitudes toward the counseling they received. Third, counseling can easily be integrated into the practices of public and private health clinics. Fourth and finally, the cost of counseling by clinic staff is lower than the cost of physician counseling. In accordance with the recommendation of

Theunissen et al. (2014), the effectiveness of counseling can be enhanced by training and feedback for counselors.

From the perspectives of patients, the major obstacles to successful partner notification emanated from cultural and psychosocial issues (Alam et al., 2010). Stigma attached to STIs was a serious barrier to disclosing the diagnosis to partners. Stigma is a ubiquitous issue in STD prevention and control. It is certainly not limited to developing countries, but may be especially relevant to specific population groups (Morris et al., 2014; Pavlin et al, 2010). Gender, power structure, and partner type were also significant issues in partner notification. These are important if not essential considerations in designing culturally tailored sexual health interventions.

Research review was also used to determine the effects of partner notification on STIs. Althaus et al. (2012, 2014) used mathematical and computational modeling as well as research review in calculating the effects of partner notification on STIs. In their initial study, Althaus et al. (2012) focused on partner notification for chlamydia, calculating the effects at the individual and population levels. The researchers created an individual-based modeling framework that allowed for the implementation of various models of STI transmission differing in complexity with attention to the changing dynamics of sexual partner networks. The results of the model simulations implied that most of the benefit of partner notification on reducing chlamydia transmission in young, heterosexual adults lies in notifying the person's current or most recent partner. Extending the notification period beyond one year had the added benefit of identifying new index cases, but the

decisive factor in the effectiveness of partner notification was the prompt treatment of current partners thus preventing reinfection and further transmission.

Using a comprehensive approach, Althaus et al. (2014) investigated the effectiveness and cost-effectiveness of various partner notification techniques for STIs. Notably, the findings for different enhanced patient referral strategies were inconclusive. There was not enough evidence to discern which method of enhanced patient referral was most effective in specific settings or to compare outcomes beyond reinfection of the index patient. There were no published randomized, controlled trials of APT during the time frame from which the literature was taken, which extended to August 2012.

Patient's sexual history is important in STD and STI treatment. According to Althaus et al. (2014), their findings confirmed the importance of taking the patient's sexual history. Their mathematical model predicted high proportions of sexual partners with chlamydia from as far back as 18 months or three previous partners. Moreover, they deem it important to be aware of the types of sexual partnerships of the index patients. The Dutch health professionals suspected that some patients minimized the number of partners in reporting their sexual histories, which would preclude accurately identifying past partners (Theunissen et al., 2014). There is no real way of knowing the accuracy of patients' self-reported sexual histories, but sexual history and relationship type affect patients' willingness to notify partners or (in cases where there is a threat to patients or partners) the prudence of patient referral versus provider referral (Taylor, 2013; Ward & Bell, 2014). Althaus et al. (2014) recommend having health advisors notify casual partners due to the prospective advantages of curbing transmission.

Interestingly, there was some incongruence between the biological and behavioral outcomes (Shiely et al., 2010). Local health jurisdictions were randomly assigned to the study's four waves at intervals of six to eight months. Health care providers were offered free medication packs to give to their patients for partners and selected pharmacies were also stocked with medication packs if the physicians chose to write prescriptions instead. The key outcome measures for each local health jurisdiction were: (1) chlamydia positivity among women between the ages of 14 and 25 tested via Infertility Prevention Project (IPP) or Planned Parenthood of Western Washington clinics, and (2) the incidence of reported cases of gonorrhea in women. Positive tests for chlamydia in young women declined significantly over the study period. Analyses indicated that the intervention produced a 10% decrease in cases of chlamydia and gonorrhea in women. Golden et al. described the impact on population-level STI as "modest."

Sexual Health Education for African American Youth

Adolescents and young adults have the highest prevalence of STIs, accounting for more than 50% of all reported infections (Francisco-Natanauan et al., 2021). Some behaviors also increase the risk of STIs and STDs that could be addressed by sexual health education (De Ravello et al., 2014). STD home testing kits could be one of the ways to address high rates of STIs and STDs. Leston et al. (2012) noted that the focus group participants expressed overwhelming support for STD home testing kits. Lack of access to sexual education might be one of the reasons for the high prevalence of STDs. Nelson et al. (2019) suggested tailored programs could help AMSM develop healthy sexual behaviors and decrease their HIV/STI risk.

Confidentiality and privacy are common concerns regardless of setting but can be magnified in small communities where everyone knows one another, as highlighted by responses of the young people in the focus groups and the adults interviewed by Torrone et al. (2011). Moreover, there was a prevailing belief that sex is something that "people don't talk about" (Leston et al., 2012. p. 4). The Internet, schools, and television were the preferred sources for information on sexual health. Some participants proposed outside experts, parents, and village clinics as potential sources for information, but most seemed reticent about approaching someone directly with questions about sexual health.

Overwhelmingly, promoting STD/HIV testing and condom use is one of the messages that was perceived positively (Leston et al., 2012). In fact, they welcomed messages conveying various options for helping young people stay healthy. Notably, the participants had numerous unanswered questions related to STDs, HIV/AIDS symptoms and treatment options. Many questions focused on chlamydia and its treatment. There was general awareness of the potentially negative impact of alcohol and drugs on sexual behavior and sexual health (Green, Eitle, & Eitle, 2015). The only gender difference was the young women's greater concern about unplanned pregnancy. According to Leston et al., the overriding perception of the participants was that "Nobody is talking to us" (p. 6). In fact, the focus group findings formed the basis of *I Know Mine* (www.iknowmine.org), a sexual health education and health promotion program for this population group. Through the website, young people can order condoms, order chlamydia and gonorrhea home testing kits offered by Johns Hopkins University *I Want the Kit Program,* find sexual health information, including an option for asking questions of Anchorage health

care providers, watch videos and read stories about STDs, HIV/AIDS, and unplanned pregnancy that demonstrate that "no question is stupid and no story is unique" (p. 9).

Sexual and gender minority (SGM) youth are at disproportionate risk for HIV (Rose & Friedman, 2017). Employing a qualitative study, Rose and Friedman (2017) examined SGM youths' perception of school sexual health education and services among a total of 42 self-identified African American SGM males participated in focus groups or in an in-depth interview. The findings of Rose and Friedman (2017) revealed schools were missing the opportunity to educate SGM youth about sexual health. Rose and Friedman found youth participants noted several barriers to accessing sexual health education and services at schools. These barriers included limited, targeted health information and school nurses not being knowledgeable of health issues that impacted SGM youth (Rose & Friedman, 2017). The findings of Rose and Friedman also indicated school sexual health services were not adequately marketed to students and sometimes did not include testing for HIV and other sexually transmitted diseases.

Stevens et al. (2017) examined the sources of sexual health information associated with youth adopting sexual risk reduction behaviors. Collecting the data in a small city in the Northeastern United States using cross-sectional behavioral surveys and modified venue-based sampling, Stevens et al. included a sample of 249 African American and Latino/a youth participants aged between 13 and 24 years. The findings of Stevens et al. (2017) revealed participants reported their sources of information about contraception and HIV/ STD, such as TV/movies, parents, social media. The participants also reported their intentions to have sex, and condom and contraception use during their last sexual

activity (Stevens et al., 2017). Stevens et al. further measured social media use, past pregnancy experience, past sexual history, age, and gender. Employing standard tests of bivariate association, including chi-squared and F-tests, Stevens et al. also examined initial associations between sexual risk reduction behavior and exposure to sexual risk reduction information on social media. The authors further used logistic regression models to test multivariate relationships between information sources and sexual risk reduction behavior. Stevens et al. found youth who were exposed to sexual health messages on social media were 2.69 times and 2.49 times more likely to have used contraception or a condom at last intercourse, respectively. The results of Stevens et al. indicated parents, schools, or traditional media as information sources were not significantly associated with contractive use or condom use at last intercourse.

Nelson et al. (2019) conducted a study to determine where adolescent males who are interested in sex with males (AMSM) received sexual health information, clarified their preferences, and explored relations with sexual behavior. Including a sample of 207AMSM participants aged between 14 and 17 years old in the United States and employing online sexual health survey as instrument for data collection, Nelson et al. assessed the bivariate associations between sexual education exposure/preferences by sexual behavior. Using Fisher's exact tests and one-way analyses of variance, Nelson et al. found 43% participants reported no sexual contact with male partners, 37% reported sexual contact without condomless anal sex, and 20% reported condomless anal sex. The results of Nelson et al. (2019) also indicated participants received sexual health information from their parents/guardians, formal sources, and the Internet (n = 135, 65%).

Nelson et al. also found the most commonly covered topics by parents/guardians and formal sources were how to say no to sex, how to prevent HIV and other sexually transmitted infections, and methods of birth control. Nelson et al. further found the most common online-researched topics were how to safely have anal sex, the types of sex you could have with a male partner, how to use a condom, and how to use lubrication. The results also indicated participants preferred a sexually-explicit online sexual health program that addressed male–male sex.

Summary and Conclusions

Patient referral emerged in the 1970s in response to escalating rates of gonorrhea that overwhelmed health services (Ward & Bell, 2014). Technology plays a prominent role, allowing the team to deliver educational materials over the Internet and communicate via teleconferencing. Technology can also be harnessed for primary prevention of STIs through education as shown by *I Know Mine* (Leston et al., 2012) and the *Native Youth Media Survey* (Rushing & Stephens, 2012). Stevens et al. (2017) provided evidence that youth sexual behavior was increasingly informed by social media messages.

Despite major efforts to control their spread and carry out specific guidelines, reported STIs are increasing (Batteiger et al., 2019; Lochner & Maraqa, 2018). Chlamydia, gonorrhea, and syphilis continue to be significant burdens to the health of individuals (Lochner & Maraqa, 2018). Mitsch et al. (2017) proposed screening for HIV infection in accordance with CDC's testing recommendations, which could lead to improvements along the continuum of HIV care. Trivedi et al. (2018) highlighted CDC

recommended repeat screening based on risk factors and geography. Trivedi et al. further emphasized that patient-reported risk factors might not sufficiently identify all those at risk for syphilis. Kularatne et al. (2018) proposed reinvigorating primary STI and HIV prevention and, especially for women, to screen for asymptomatic infections. Stanford et al. (2021) proposed universal screening was needed for STIs. Stanford et al. also argued routine emergency departments STI screening in high-prevalence communities would be critical to addressing the epidemic. Stanford et al. further argued with STI rates rising rapidly in the United States, novel means of reaching high-risk populations for screening and treatment were needed. Francisco-Natanauan et al. (2021) highlighted a need for universal and timely testing to allow the treatment of those infected.

Research evidence suggests race, gender, and age are associated with different types of STIs (Francisco-Natanauan et al., 2021; Habel et al., 2018; Mitsch et al., 2017). Mitsch et al. (2017) argued to improve individual health and to prevent HIV, outcomes must improve. Rose and Friedman (2017) argued schools played an integral role in educating young people about sexual health in addition to providing sexual health services. Rose and Friedman recommended future research for school nurses and sexual health services. Stevens et al. (2017) proposed health practitioners utilize social media as an important health promotion tool. Kularatne et al. (2018) highlighted the need to enhance STI services beyond clinic-based syndromic case management. Habel et al. (2018) recommended future discussing the benefits of extragenital STD testing for heterosexuals. Nelson et al. (2019) proposed developing online sexual education programs that explicitly addressed male–male sex.

However, a comprehensive review of the literature reveals few attempts have been conducted to examine the relationship between different types of STI infection, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age among African Americans in the United States. In response, the researcher aims to study this research problem using a quantitative, cross-sectional, non-experimental, correlational design. As such, this study could advance knowledge and enrich the literature.

In Chapter 3, the research methodology and research design are discussed. The data collection and data analysis procedures are also presented. Moreover, the ethical considerations for this study are discussed.

Chapter 3: Research Method

The purpose of this quantitative correlational design was to examine the relationship between different types of STI infection, specifically chlamydia, gonorrhea, and syphilis, and race, gender, and age. The participants of the study are individuals who reside or have resided in Colorado who have or are currently undergoing treatment for chlamydia, gonorrhea, or syphilis infection. A secondary data collection approach was adopted where data was sourced from the Colorado Department of Public Health and Environment. Generally, Chapter 3 involves a discussion of the methods and approaches that will be used in data collection. Specifically, the chapter starts with a discussion of the research design and its appropriateness to the current study. Additionally, the chapter involves a description of the population, sampling procedures, recruitment and data collection procedures was outlined next. Operationalization of constructs and data analysis plan are presented afterwards. Threats to validity as well as ethical procedures will also be discussed. Finally, I present a summary of the important details about the proposed methodology in the chapter.

Research Design and Rationale

I opted for a quantitative correlational design. The term quantitative denotes the notion that the researcher is tailored towards examining questions of "how many" and to determining relationships between variables (Lee, 2014). Similarly, the term correlational denotes measurement of the extent of association between two or more variables. Consequently, a quantitative correlational design entails the measurement of the degree of association among variables. The quantitative correlational design is well suited to the

current study as it aligns perfectly with the study's purpose, which is to determine the relationship between the number of cases of chlamydia, gonorrhea, and syphilis (dependent variable) and race, gender, and age (independent variables). According to Johnson (2001), quantitative correlational research must involve operationalization and measurement of variables as well as the associations among them. As such, the current study fits perfectly into the realm of quantitative research. By contrast, qualitative research is descriptive, focusing on issues of "why" or "how" (Lee, 2014), and deals with the experiences of individual participants rather than the statistically aggregated experiences of a larger sample. Thus, qualitative research is inappropriate for the purpose of this study.

Correlational research design allows for the examination of relationships between variables with the use of statistical tests (Johnson, 2001), which coincides with the purpose of the study. Although, correlational research design does not have the ability to provide inferences about the causal relationships between variables, providing statements of correlation are still meaningful results for policy and future research (Johnson, 2001). As such, a nonexperimental design rather than an experimental design that requires manipulation of variables was employed. Further, this study made use of cross-sectional data that provided a broad picture of a population at a single point in time (see Johnson, 2001). Such type of data was chosen the most suitable to exploring treatment of STIs, which happens over a short period for any given patient.

Methodology

Population

The general population was people in the United States who have been treated for chlamydia, gonorrhea, or syphilis. The target population for the study was composed of people in the state of Colorado who have been treated for chlamydia, gonorrhea, or syphilis. Specifically, I used a secondary data set obtained from the Colorado Department of Public Health and Environment which provided a thorough surveillance profile of chlamydia, gonorrhea, and syphilis from 2019 data. It includes breakdowns by age, sex, and race. The determination for the sample size follows G*Power approach and is explained in the Sampling and Sampling Procedures section.

Sampling and Sampling Procedures

I employed purposive sampling for this study. Purposive sampling is a nonprobability sampling technique in which the researcher relies on their own judgment when choosing members of population to participate in the study based on characteristics of a population and the objective of the study (Yang & Banamah, 2014). Purposive sampling was conducted because it had certain advantages applicable for this study. These include greater accessibility, faster speed, and lower costs associated in recruiting samples for the study (Coy, 2008). A purposive sampling strategy was chosen for the study because participants need to meet a specific set of inclusion criteria to be eligible to be able to participate in the study (see Yang & Banamah, 2014). The inclusion criteria of the study were (a) have been diagnosed with chlamydia or gonorrhea or syphilis, or any of the two or three symptoms; (b) are currently undergoing or have undergone treatment

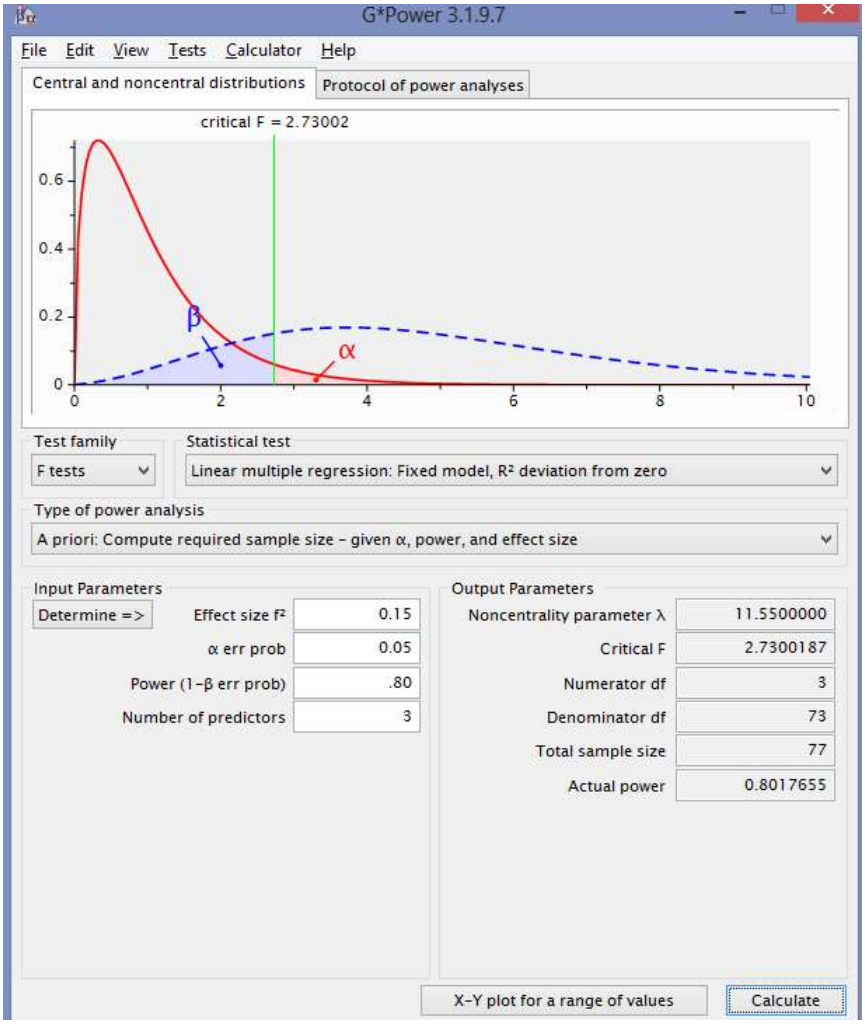
for chlamydia, gonorrhea, or syphilis and (c) currently reside or have resided in Colorado.

A power analysis was conducted to determine the minimum required sample size for the study. The power analysis considered four factors: (a) the level of significance, (b) the power of test, (c) effect size, and (d) the statistical technique (see Faul et al., 2013). The level of significance refers to the probability of rejecting a null hypothesis given that it is true, which is commonly referred to as the Type I error (Haas, 2012). The level of significance is usually denoted with an alpha and in most quantitative studies is set at 95% (0.05; Creswell, 2012).

The power of test refers to the probability that the test correctly rejects a false null hypothesis thus accepting the alternative hypothesis (Haas, 2012). In most quantitative studies, an 80% power of test is used. The effect size indicates the estimated degree of relationship between predictor and criterion variables (Cohen, 1988). Effect size is normally categorized into small, medium, and large and medium effect size is commonly used for quantitative studies as it strikes balance between being too strict and lenient in estimating the degree of relationship between the variables (Berger et al., 2013). Lastly, the statistical technique was also considered for the computation of the sample size. The statistical technique to address the research questions was multiple linear regression. Using multiple regression, medium effect size 0.05 alpha level, and 80% power of test will require a minimum of 77 (Figure 1).

Figure 1

G Power Sample Size Calculation for Multiple Regression*



In case the desired count of at least 77 cases was not received, bootstrapping would have been applied to the data analysis. The bootstrap provides an opportunity to use statistics to conclude a small sample population (Mooney & Duval, 1993).

Procedures for Recruitment, Participation, and Data Collection

Prior to embarking on the actual collection of data, the researcher sought approval from Walden University's Institutional Review Board (IRB) and site permission for data

collection. I was granted approval to move forward with the actual data collection by the university. After the approval, I sought permission to access the required dataset from the Colorado Department of Public Health and Environment. The type of data the researcher uses in the current study consisted of medical records of patients (a) that had undergone treatment for chlamydia, gonorrhea, or syphilis, or all, or (b) were still undergoing treatment for chlamydia, gonorrhea, or syphilis, or all, at the time of study. In essence, I exclusively made use of secondary data. One of the key limitations of secondary data collection is that the researcher has limited control over the data collection process including decisions regarding sample size, target population, and time of data collection, among others. Additionally, with secondary data, it is difficult to determine how exactly the original data was collected and whether standard data collection procedures were followed. Nevertheless, in the current study, I had a clear grasp of how the original data was collected.

Since the data involved medical records of patients who had been treated or were undergoing treatment of the STIs chlamydia, gonorrhea, or syphilis, the data collection process typically involved the responsible healthcare practitioners recording patients' STI results, treatment data, and demographic data. As such, data was typically collected by healthcare practitioners that handled respective cases of chlamydia, gonorrhea, or syphilis. For every patient visit, the respective healthcare practitioners recorded key data on the patient's race, gender, and age.

Instrumentation and Operationalization of Constructs

The data collection process was accomplished by retrieving data from the Colorado Department of Public Health and Environment. Infection type, race, gender, and age were the variables collected. Specifically, the researcher used a secondary data set obtained from Colorado Department of Public Health and Environment which provided a thorough surveillance profile of chlamydia, gonorrhea, and syphilis from 2019 data. It included breakdowns by age, sex, and race. The inclusion criteria of the study were: (a) have been diagnosed with chlamydia or gonorrhea or syphilis, or any of the two or three symptoms; (b) are currently undergoing or have undergone treatment for chlamydia, gonorrhea, or syphilis. The data was included at the individual level, where individual cases of chlamydia, gonorrhea, or syphilis were examined, with demographic characteristics of individuals as predictors.

Data on infection type was collected by the healthcare practitioners conducting tests for chlamydia, gonorrhea, and syphilis, recording the result in the respective patients' medical records. As such, the instrument used to collect data on infection type was a test for chlamydia, gonorrhea, and syphilis. Consequently, the number of cases of infection (chlamydia, gonorrhea, or syphilis) was measured on an interval scale. Gender was operationalized based on the self-proclaimed gender identities of the respective patients. Typically, a person would identify themselves as either male (coded as 0) or female (coded as 1). Age was categorized as 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-54, 55-64, and 65+. This was then treated as an ordinal variable ranging from 1 (category 10-14) to10 (category 65+). In this way, increasing values in this newly

recoded age variable corresponds to increasing age. An ordinal may be treated as interval if there are at least 5 responses, (Wu & Leung, 2017). According to Wu et al. (2017), more scale points will result in a closer approach to the underlying distribution, and hence normality and interval scales. Lastly, race (measured at the nominal level of measurement) includes the categories of , Black, Hispanic, Unknown Hispanic, Other and White. The race variable was dummy coded into six dichotomous variables where a value of one indicates into that race category and zero indicating exclusion.

Data Analysis Plan

The data analysis for this study was performed using SPSS to provide a range of descriptive as well as inferential statistics, including statistical correlations. The SPSS software offers advanced statistical analysis, machine learning algorithms, and text analysis (Alcalá-Fdez et al., 2009). All required statistical tests for this study were easily conducted in SPSS.

All data was pre-processed using Microsoft Excel. Pre-processing aims to ensure a clean data set by excluding data outliers and missing data. Only those participants who have complete information on both the independent and dependent variables were included in the data analysis. Once a complete, clean data set had been achieved it was then exported to SPSS for data analysis.

The following are the research questions and corresponding hypotheses that will guide and be addressed in this study.

RQ1: What is the relationship between the number of cases of chlamydia infections and sex, age, and race?

Ho_1: There is no significant relationship between the number of cases of chlamydia infections and sex, age, and race.

$H1_1$: There is a significant relationship between the number of cases of chlamydia infections and sex, age, and race.

RQ2: What is the relationship between the number of cases of gonorrhea infections and sex, age, and race?

$H0_2$: There is no significant relationship between the number of cases of gonorrhea infections and sex, age, and race

$H1_2$: There is a significant relationship between the number of cases of gonorrhea infections and sex, age, and race.

RQ3: What is the relationship between the number of cases of syphilis infections and sex, age, and race?

$H0_3$: There is no significant relationship between the number of cases of syphilis infections and sex, age, and race.

$H1_3$: There is a significant relationship between the number of cases of syphilis infections and sex, age, and race.

There are two types of statistical analysis that were conducted for this study, and these are descriptive statistics and inferential statistics. Descriptive statistics will be conducted to characterize the data that have been gathered from the data set. Specifically, the frequency distribution and percentages will be used to describe the data that have been gathered (Hoe & Hoare, 2012). On the other hand, inferential statistics will be conducted to draw conclusions about the target population. Multiple linear regression

analysis is used to predict a continuous dependent variable based on several independent variables (Mertler & Vannata, 2013). Additionally, multiple regression analysis also determines the overall fit and the relative contribution of each of the predictor to the total variance explained (Mertler & Vannatta, 2013). The approach for the study included multiple regression analyses to test for the effects of the independent variables on the dependent variables.

Prior to conducting multiple regression, the parametric assumptions were tested. Parametric assumptions are statistical tests conducted to determine when normality or homogeneity of variance assumptions are met or satisfied (Mertler & Vannatta, 2013). Mertler and Vannatta (2013) said that multiple regression analysis includes linearity, normality, and homoscedasticity. (Mertler & Vannatta, 2013). Plots of the standardized residuals and the standardized predicted values will be examined to assess linearity and homoscedasticity. If the plots are not curvilinear, there are no violations of the assumption of linearity (Field, 2018; Tabachnick & Fidell, 2012). Additionally, if the plots form a rectangular pattern, there is no violation of the assumption of homoscedasticity (Field, 2018; Tabachnick & Fidell, 2012). A Shapiro-Wilk test of normality will be used to determine if the data were normally distributed (Field, 2018; Tabachnick & Fidell, 2012). Kurtosis and skewness statistics will be generated to further assess normality. Finally, the variable inflation factor (VIF) will be calculated for each variable to determine if there is a violation in multicollinearity between any two variables (Mertler & Vannatta, 2013). Outlier detection was assessed through calculation of standardized regression residual scores.

Threats to Validity

The validity of the results of quantitative research was heavily based on the data that are provided by Colorado Department of Public Health and Environment. The data that was retrieved was used to measure the independent and dependent variables. To ensure the data was relevant the researcher ensured only data that met the inclusion criteria was considered for analysis.

Ethical Procedures

The proposed study began with IRB approval from the university, so as to ensure ethical standards were met. After which, the researcher sought site permission from the Colorado Department of Public Health and Environment for collecting data. The research was not expected to pose any harm to participants for several reasons. Firstly, the nature of anonymous quantitative data collection was such that no identifying information was collected that can be linked back to the participants. Pseudo codes were used to designate each participant, (i.e., P01 for participant number one and so on). Secondly, the participants were not a vulnerable population. The data was collected in this study was deidentified prior to release to the researcher. Hard copies of raw data and other documents pertinent to the study are securely kept in a locked filing cabinet inside the personal office of the researcher. Soft copies of raw data and other documents are saved in a password-protected flash drive. All data and documents related to the study will be destroyed three years after completion. Hard copies will be shredded while soft copies will be deleted.

Summary

The purpose of this quantitative correlational design was to examine the relationship between different types of STI infection, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age. The data for the study was gathered using a deidentified data set provided by the Colorado Department of Public Health and Environment. Data from individuals in the state of Colorado who have undergone or are currently undergoing treatment for chlamydia or gonorrhea, or syphilis was selected to participate in the study.

Data were subjected to descriptive and inferential analysis using multiple linear regression to identify whether significant relationships existed among the independent and dependent variables. The chapter included detail about the research questions and corresponding hypothesis, population, sample size, data collection procedures, and data analysis procedures. Chapter 4 will present the findings about the possible relationships between variables.

Chapter 4: Results

The purpose of this quantitative correlational design was to examine the relationship between different types of STIs, specifically, chlamydia, gonorrhea, and syphilis, and race, gender, and age in the United States. The following research questions were addressed:

- RQ1: What is the relationship between the number of cases of chlamydia infections and sex, age, and race?
- RQ2: What is the relationship between the number of cases of gonorrhea infections and sex, age, and race?
- RQ3: What is the relationship between the number of cases of syphilis infections and sex, age, and race?

The following is a discussion of the projects' population and sample as well as a demographic description of the sample. Demographic descriptions included frequencies and percentages for categorical (nominal) variables and means and standard deviations of variables measured at the interval level. Also presented are the testing of parametric assumptions for the statistical analysis and results of statistical testing. This chapter concludes with a discussion of the results of this project.

Data Collection

The target population for the study was composed of people in the state of Colorado that have been treated for chlamydia, gonorrhea, or syphilis. Specifically, I used a secondary data set obtained from Colorado Department of Public Health and Environment which provided a thorough surveillance profile of chlamydia, gonorrhea,

and syphilis from 2019 data. It included breakdowns by age, sex, and race. The inclusion criteria of the study were (a) have been diagnosed with chlamydia or gonorrhea or syphilis, or any of the two or three symptoms and (b) are currently undergoing or have undergone treatment for chlamydia, gonorrhea, or syphilis. The data was included at the individual level, where individual cases of chlamydia, gonorrhea, or syphilis were examined, with demographic characteristics of individuals as predictors.

Descriptive Statistics

The analysis of the secondary data for the study included the examination of descriptive statistics. Descriptive statistics examined included mean as a measure of central tendency, standard deviation as a measure of variance, and the minimum, maximum, and range values as indicators of the range of observations. The descriptive statistics section includes these statistics for the age of respondents as delineated by the race, Hispanic status, and assigned sex at birth of participants. The descriptive statistics support gaining a greater understanding of the cases included in the study and could support future interpretation of findings. The inclusion of these descriptive statistics that include race, assigned sex, and age also supports the exclusion validity, specifically population validity, of the study by elucidating for the reader the profile characteristics of participants.

The mean age of the reported cases of chlamydia, gonorrhea, and syphilis were examined by the race, Hispanic status, and assigned sex at birth among participants in the survey. The findings of the survey can be found in Table 1. There were some differences and similarities in the data that were critical to developing a general understanding of the

sample. Among the individual participating that had reported cases of chlamydia, gonorrhea, or syphilis, assigned sex appeared to have the greatest bearing on the mean age, as while the highest mean age was for males (M = 29.15, SD = 10.01), the lowest was for females (M = 24.03, SD = 7.40). The mean age for individuals participating that had reported cases of chlamydia, gonorrhea, or syphilis was the same among individuals reporting a race of Black (M = 25.79, SD = 8.95) or Unknown (M = 25.79, SD = 8.43), and similar to individuals reporting a Hispanic status of Hispanic (M = 25.46, SD = 8.37) and unknown (M = 25.69, SD = 8.37), as each was within the 25-26 year old range. Therefore, Table 1 is evidence that while there was a range in participants of 0-84 years old, central tendency is such that the mean of participants is generally within the 25-26 range, depending on profile characteristics, with the lowest and highest mean belonging to individuals assigned male or female at birth.

Table 1

Mean Age for Reported Cases of Chlamydia, Gonorrhea, or Syphilis by Race, Hispanic Status, and Assigned Sex at Birth

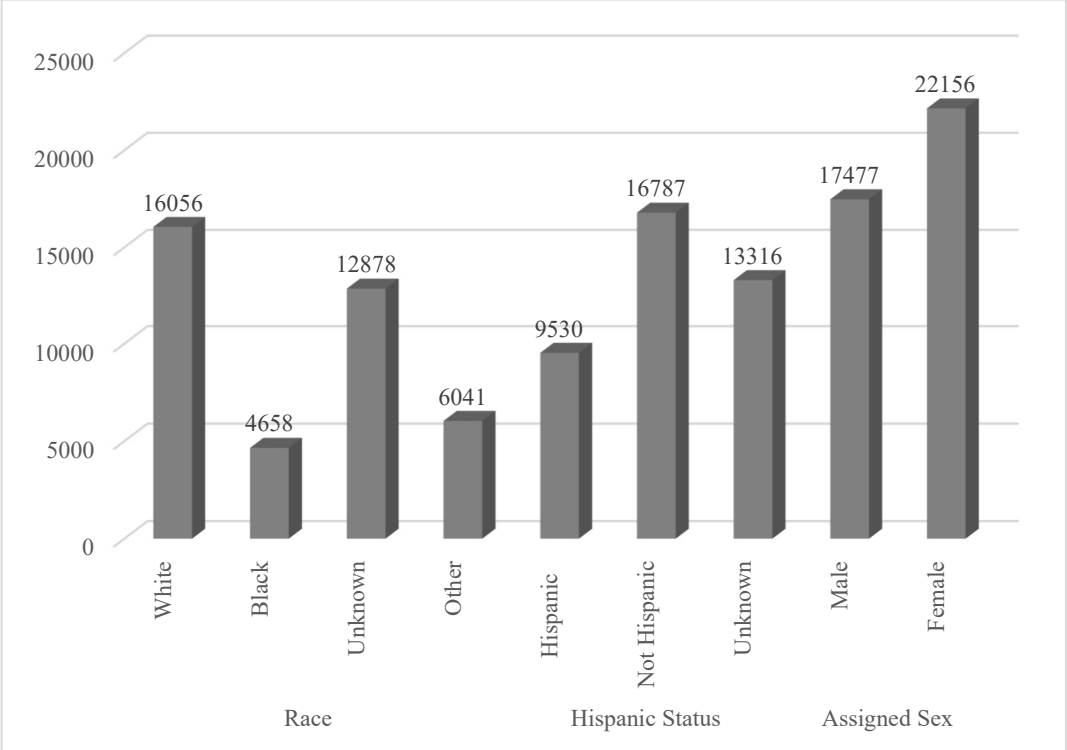
		M	*SD*	MIN	MAX	RANGE
Race	White	27.48	9.69	0.00	84.00	84.00
	Black	25.79	8.95	0.00	70.00	70.00
	Unknown	25.79	8.43	0.00	81.00	81.00
	Other	24.56	7.91	0.00	71.00	71.00
Hispanic Status	Hispanic	25.46	8.37	0.00	84.00	84.00
	Not Hispanic	27.23	9.74	0.00	78.00	78.00
	Unknown	25.69	8.37	0.00	81.00	81.00
Assigned Sex	Male	29.15	10.01	0.00	84.00	84.00
	Female	24.03	7.40	0.00	71.00	71.00

The descriptive statistics also include a bar graph of the frequencies for reported cases of chlamydia, gonorrhea, and syphilis based on race, Hispanic status, and assigned sex at birth. Figure 2 includes the bar graph illustrating these findings. Among the findings was the discovery of White individual having the highest frequency of chlamydia, gonorrhea, or syphilis infection. Among race, the most frequent case count was among White participant (n= 16,056), while the least frequent was among Black participants (n = 4,658). Within the scope of Hispanic status, individuals reporting as non-Hispanic had the highest frequency (n = 16,787), while Hispanic had the lowest

count (n = 9,330). Individuals assigned female at birth had a higher frequency of infection (n = 22,156), than individuals assigned male at birth (n= 17,477). The findings from Table 1 and Figure 2 support understanding that while individuals assigned female at birth had the lowest mean age (M = 24.03, SD = 7.40) for infection, they also had the highest frequency of infection (n = 22,156).

Figure 2

Frequency of Reported Cases of Chlamydia, Gonorrhea, or Syphilis by Race, Hispanic Status, and Assigned Sex at Birth



When chlamydia infection is the focus, rather than chlamydia, gonorrhea, and syphilis together as in Table 1 and Figure 2, there are some differences and similarities observed in the central tendency and frequencies reported. Like in Table 1, the findings in Table 2 include evidence of the highest mean age belonging to individuals assigned

male at birth (M = 27.49, SD = 9.16), while the lowest mean age belonged to individuals assigned female at birth (M = 23.50, SD = 6.94). A difference between the findings from Table 1 and Table 2 is that while race and Hispanic status appeared to have mean scores that clustered in the 25-26 years of age range, the age range for individuals only reporting a chlamydia infection was generally clustered in the 24-25 age range, with assigned sex being the only characteristic where mean ages deviated from the pattern.

Table 2

Mean Age for Reported Cases of Chlamydia by Race, Hispanic Status, and Assigned Sex at Birth

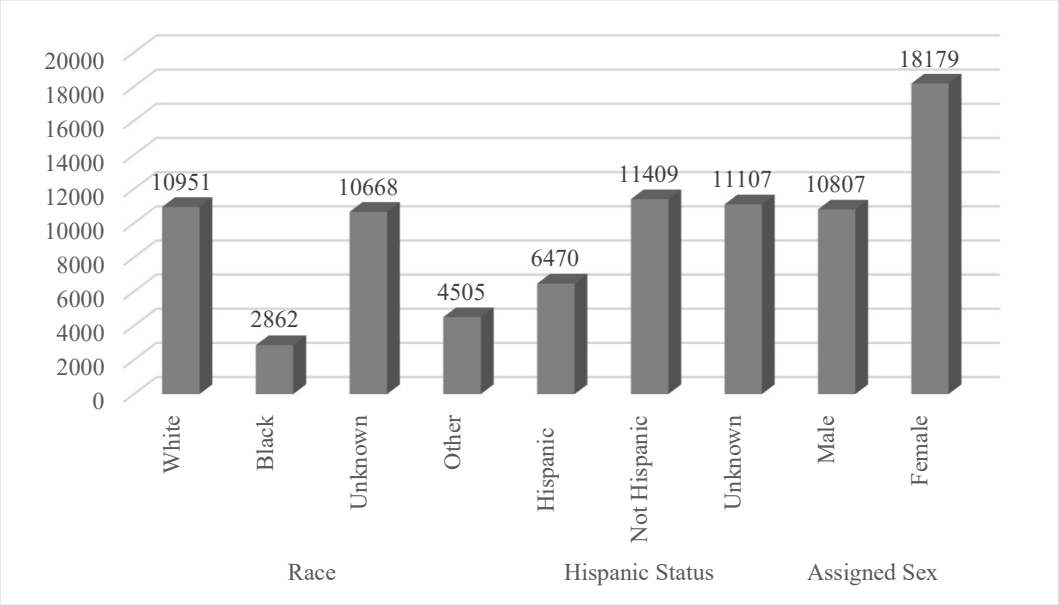
		M	*SD*	MIN	MAX	RANGE
Race	White	25.55	8.55	10.00	78.00	68.00
	Black	24.20	7.74	4.00	70.00	66.00
	Unknown	25.11	7.91	0.00	81.00	81.00
	Other	23.81	7.35	0.00	71.00	71.00
Hispanic Status	Hispanic	24.24	7.61	0.00	71.00	71.00
	Not Hispanic	25.39	8.49	4.00	78.00	74.00
	Unknown	25.01	7.87	0.00	81.00	81.00
Assigned Sex	Male	27.49	9.16	0.00	81.00	81.00
	Female	23.50	6.94	4.00	69.00	65.00

The patterns observed in Figure 2 were consistent in Figure 3, concerning the least frequent and most frequent instances of chlamydia infection following the same trends as the group of individuals infected with chlamydia, gonorrhea, and syphilis.

Among race, the most frequent case count was among White participant (*n*= 10,951), while the least frequent was among Black participants (*n* = 2,862). Within the scope of Hispanic status, individuals reporting as non-Hispanic had the highest frequency (*n* = 11,409), while Hispanic had the lowest count (*n*= 6,470). Individuals assigned female at birth had a higher frequency of infection (*n* = 18,179), than individuals assigned male at birth (*n* = 10,807). Therefore, the trends for frequencies for mean age of reporting chlamydia along the race, Hispanic status, and assigned sex at birth are consistent with those of individuals infected with chlamydia, gonorrhea, and syphilis.

Figure 3

Frequency of Reported Cases of Chlamydia by Race, Hispanic Status, and Assigned Sex at Birth



The patterns observed in Table 1 and Table 2 are relatively different in Table 3. Table 3 includes the mean age for reported cases of gonorrhea by race, Hispanic status, and assigned sex at birth. While the mean age is lowest for individuals assigned female at

birth (*M* = 26.19, *SD* = 8.68), the highest mean age is for individuals assigned male at birth (*M* =30.96, *SD* = 10.24). While Table 1 and Table 2 included an observable cluster within a single year age range for race and Hispanic status, the mean age for individuals by race and Hispanic status ranged from the lowest among races as being other (*M* = 26.56, *SD* = 8.99) and highest among individuals whose race was White (*M* = 30.49, *SD* = 10.11), with a mean difference of 3.93 years. The mean difference in Hispanic status was 2.95 years, with the highest mean age belonging to individuals reporting as not Hispanic (*M* = 30.11, *SD* = 10.43) and the lowest mean age belonging to individuals reporting as Hispanic (*M* = 27.16, *SD* = 8.76). These patterns of White participants having the highest mean age among race and other having the lowest mean age, as well as being not-Hispanic having the highest mean age and Hispanic having the lowest mean age was consistent with means reported in Table 1 and Table 2. Thus, while the distance in means among the groups of Hispanic status and race are growing, their order remained consistent (Table 3).

Table 3

Mean Age for Reported Cases of Gonorrhea by Race, Hispanic Status, and Assigned Sex at Birth

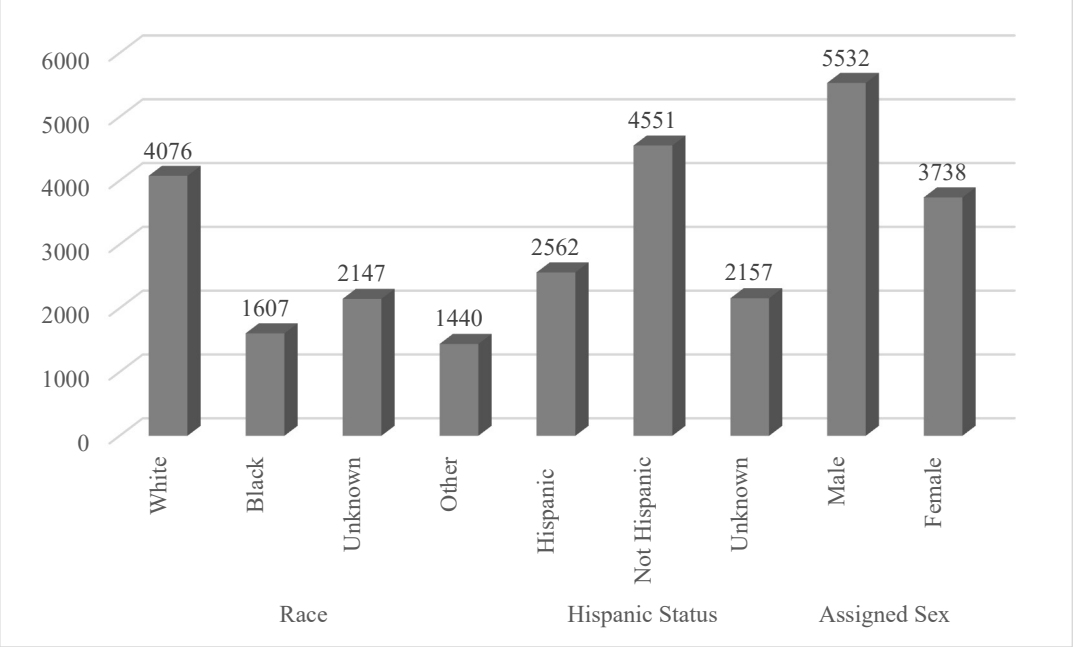
		M	*SD*	MIN	MAX	RANGE
Race	White	30.49	10.11	4.00	75.00	71.00
	Black	27.59	9.76	3.00	69.00	66.00
	Unknown	29.01	9.80	13.00	81.00	68.00
	Other	26.56	8.99	13.00	70.00	57.00
Hispanic Status	Hispanic	27.16	8.76	13.00	70.00	57.00
	Not Hispanic	30.11	10.43	3.00	75.00	72.00
	Unknown	29.00	9.80	13.00	81.00	68.00
Assigned Sex	Male	30.96	10.24	4.00	81.00	77.00
	Female	26.19	8.68	3.00	71.00	68.00

There were some differences observed between the frequencies reported in Figure 2 and Figure 3 with Figure 4. While the most frequent race represented was White (n = 4,076), The least frequent was other (n = 1,440). In Figure 2 and Figure 3 the least frequent was Black. Like in Figure 2 and Figure 3, the most frequent group among Hispanic status was not Hispanic (n = 4,551). However, while the least frequent group was Hispanic in Figure 1 and Figure 2, the least frequent in Figure 4 was unknown (n= 2,157). While individuals reporting as assigned female at birth had reported a greater frequency of cases in Figure 2 and Figure 3 than individuals assigned male at birth, the

greater frequency was individuals assigned male at birth (*n*= 5,532), not individuals assigned female at birth (*n*= 3,738).

Figure 4

Frequency of Reported Cases of Gonorrhea by Race, Hispanic Status, and Assigned Sex at Birth



The mean age for reported cases of syphilis by race, Hispanic status and assigned sex at birth includes several differences from the observed statistics in Table 1, Table 2, and Table 3. One difference involves the assigned sex at birth. While the mean age for individuals who are assigned male at birth (M = 36.12, SD = 11.93) is higher than that of individuals assigned female at birth (M = 30.85, SD = 9.70), there are mean ages lower and higher than those of individuals by assigned sex. The lowest mean age was within the category of race and was other (M = 29.64, SD = 8.81), while the highest mean age was in the category of Hispanic status and was based on individuals who were not

Hispanic (M = 36.82, SD = 12.28). These findings are evidence of syphilis following different trends than chlamydia and gonorrhea.

Table 4

Mean Age for Reported Cases of Syphilis by Race, Hispanic Status, and Assigned Sex at Birth

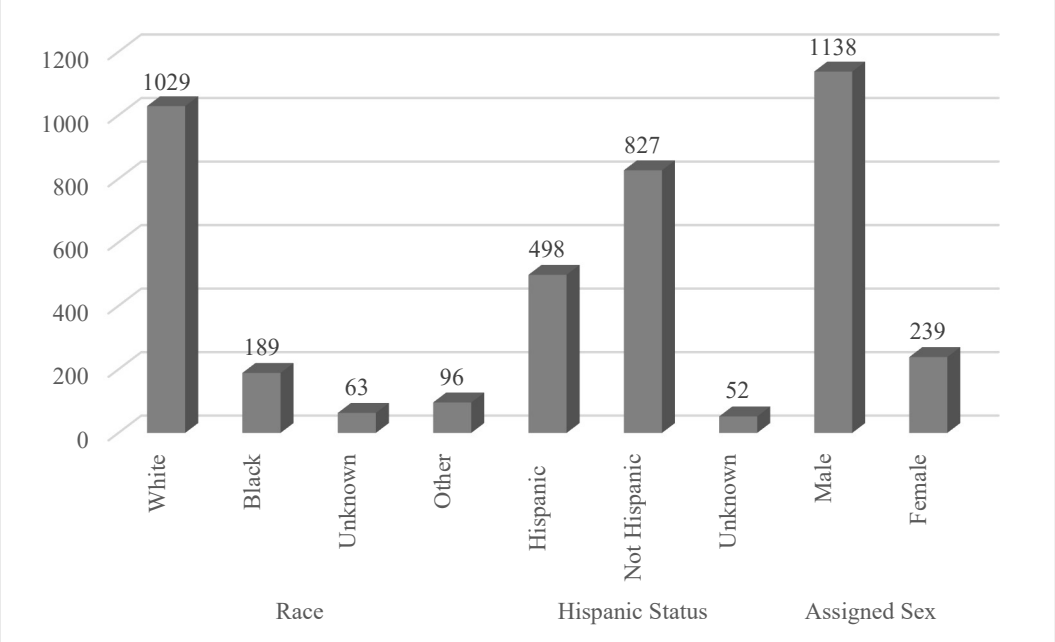
		M	*SD*	MIN	MAX	RANGE
Race	White	36.11	11.59	0.00	84.00	84.00
	Black	34.55	11.83	0.00	66.00	66.00
	Unknown	30.76	14.49	0.00	64.00	64.00
	Other	29.64	8.81	0.00	51.00	51.00
Hispanic Status	Hispanic	32.66	10.41	0.00	84.00	84.00
	Not Hispanic	36.82	12.28	0.00	75.00	75.00
	Unknown	33.83	10.88	16.00	64.00	48.00
Assigned Sex	Male	36.12	11.93	0.00	84.00	84.00
	Female	30.85	9.70	0.00	60.00	60.00

The findings in Figure 5 include evidence of a few characteristics of participants that are must be noted. First, by far, individuals whose race was reported as White had a higher frequency of syphilis infection than individuals of other races (n = 1,029). While this finding is consistent with Figure 2, Figure 3, and Figure 4, the frequency observed in Figure 5 is much higher than the other races. The other finding involves the assigned sex at birth. Individuals assigned male at birth had a much higher frequency (n = 1,138) than

individuals assigned female at birth (n = 239). While this too was consistent with Figure 2, Figure 3, and Figure 4, the size of the difference in frequency is remarkable and serves as evidence of a greater frequency of White males infected with syphilis in the sample.

Figure 5

Frequency of Reported Cases of Syphilis by Race, Hispanic Status, and Assigned Sex at Birth



Results

The results section includes the findings concerning the three research questions for this study. Hypothesis tests were performed to determine the statistical significance of age, race, Hispanic status, and assigned sex. Each research question includes a null and alternative hypothesis, with the null and alternative hypotheses tested at $p < 0.05$ as the threshold for statistical significance. The results section begins with the findings

concerning the model summary for the three regression models where age, race, Hispanic status, and assigned sex were predictors of criterion variables involving the status of participants as either infected with chlamydia, gonorrhea, or syphilis, or not infected with chlamydia, gonorrhea, or syphilis. The section continues with each research question. A discussion of statistical assumptions is included with each research question. The discussion of statistical assumptions included a scatterplot of regression standardized residuals and predicted values and a histogram of regression standardized residuals. Each research question included findings indicating violation of statistical assumptions. Each research question section concludes with a table of logistic regression model coefficients.

RQ1

RQ1: What is the relationship between the number of cases of chlamydia infections and sex, age, and race?

$H_0$1: There is no significant relationship between the number of cases of chlamydia infections and sex, age, and race.

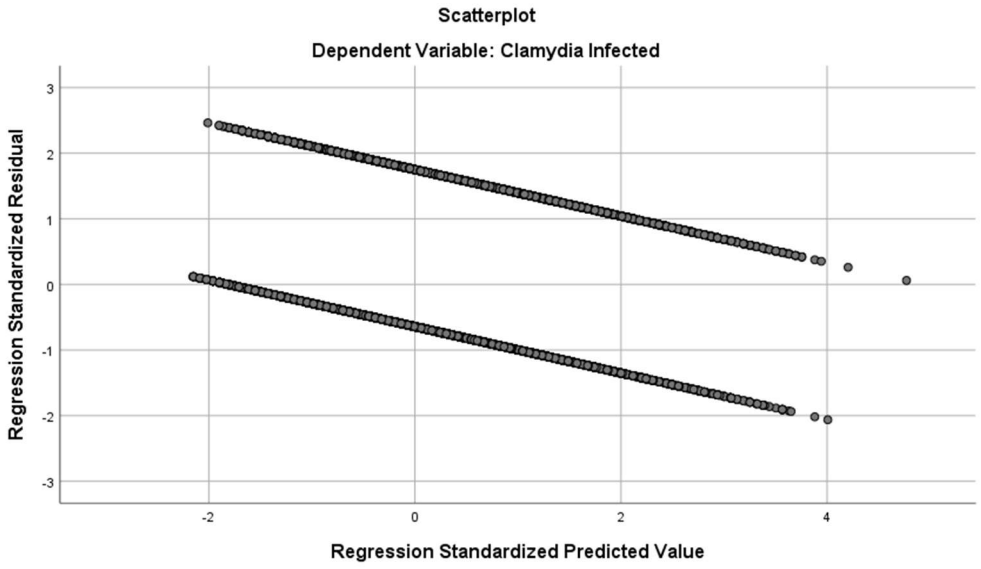
$H_1$1: There is a significant relationship between the number of cases of chlamydia infections and sex, age, and race.

Multiple regression was selected to test the relationship between sex, age, and race as predictors of the criterion variable of chlamydia infection status. Prior to completing regression analysis, the statistical assumptions for regression analysis must be examined. The existence of a linear relationship was tested using a scatterplot. Figure 6 supports the statistical assumption of a linear relationship. Homoscedasticity was then tested. The existence of homoscedasticity was tested using a scatterplot. Based on Figure

6, there is evidence supporting the assumption of homoscedasticity as present in the regression model.

Figure 6

Regression Standardized Residuals and Predicted Values for Variables in RQ1



The statistical assumption of multivariate normality was tested using a histogram (Figure 7). The findings from the histogram support the existence of multivariate normality. Autocorrelation was then tested. Autocorrelation, or independence, was examined using the Durbin-Watson test. The findings include $D\text{-}W = 0.10$. As an acceptable $D\text{-}W$ statistic is $1.5 < D\text{-}W < 2.5$, the assumptions test for autocorrelation failed. Last, the assumption of multicollinearity. The assumption of little to no multicollinearity failed. The assumption failed based on the VIF and tolerance scores for the variables for unknown as Hispanic and Unknown race (VIF = 13.35 and 13.35, respectively). Therefore, there is multicollinearity and autocorrelation, violating two

assumptions of multiple regression analysis. Based on the violations of statistical assumptions, logistic regression was selected as a replacement test for hypothesis testing.

Figure 7

A Histogram of Standardized Residuals for the Regression Model for RQ1

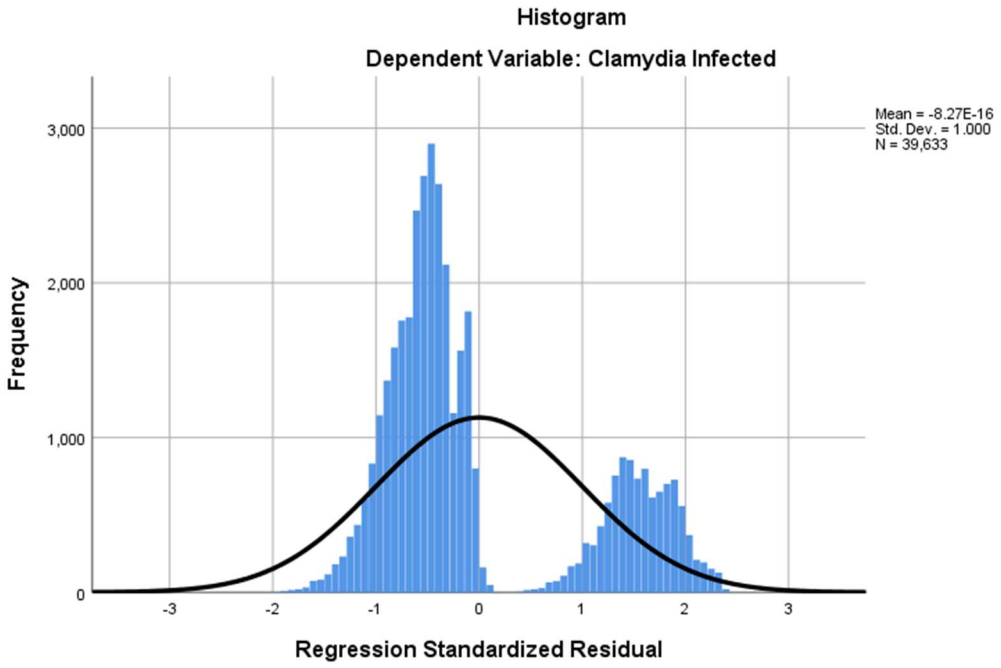


Table 6 includes the model coefficients for Research Question 1 based on logistic regression. Each predictor variable was significant at $p < 0.05$. Table 5 includes the model summary for the regression model testing the relationship between age, race, and assigned sex as predictors of chlamydia infection. The model summary includes findings indicating the model is significant at $p < 0.05$ (sig. = 0.00).

These findings are evidence that while all factors were found to be significant in the model, the factor with the greatest strength of effect was if an individual was or was not Unknown as Hispanic (B = 0.97). The data included coding for Unknown as Hispanic

Yes or No as Yes = 1 and No = 2. The coding for Chlamydia status included the code of Positive = 1 and Negative = 2. The direction of the relation being positive is evidence that being unknown as Hispanic was the strongest predictor of chlamydia infection status as positive. The strength of the finding of an individual being unknown as Hispanic as the finding with greatest strength was followed by the birth sex of individuals in the sample (B = -0.79). Birth sex was coded as Male = 1 and Female = 2. The finding that B is negative is evidence that being female was a strong predictor of chlamydia infection status. The strength of the effect is followed by an individual's status as Black Yes or No (B = -0.69). Status as Black Yes or No was coded as Black Yes = 1 and Black No = 2. The negative relationship between Status as Black Yes or No and Chlamydia infection status is evidence that Not being Black is a significant predictor of Chlamydia infection status. While a statistically significant variable in the model, age had the least significant effect (sig. = 0.00, B = 0.05). The finding is evidence that as age increased, the Chlamydia status of an individual was more likely to be negative.

Table 5

A Table of Regression Model Coefficients for Research Question 1

	B	S.E.	Wald	Df	Sig.	Exp(B)
Age	0.05	0.00	1209.61	1.00	0.00	1.05
Birth Sex	-0.79	0.03	1010.89	1.00	0.00	0.45
Hispanic Yes or No	-0.40	0.04	129.02	1.00	0.00	0.67
Unknown as Hispanic Yes or No	0.97	0.11	72.43	1.00	0.00	2.65
Black Yes or No	-0.69	0.05	163.42	1.00	0.00	0.50
White Yes or No	-0.22	0.04	28.09	1.00	0.00	0.80
Unknown Race Yes or No	-0.58	0.11	25.99	1.00	0.00	0.56
Constant	0.59	0.28	4.61	1.00	0.03	1.80

Dependent Variable: Chlamydia infection status

RQ2

RQ2: What is the relationship between the number of cases of gonorrhea infections and sex, age, and race?

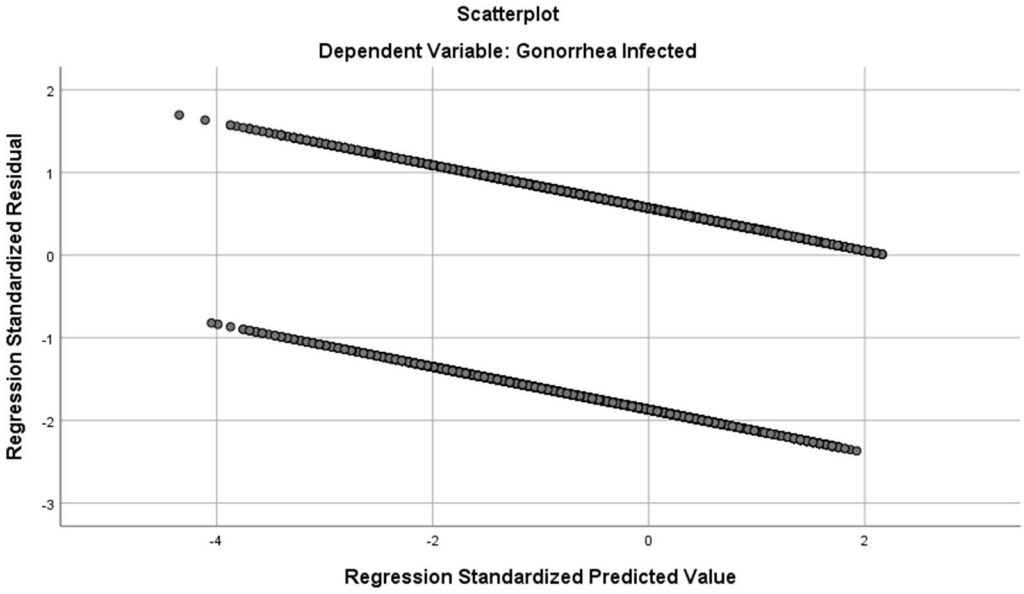
$H0_2$: There is no significant relationship between the number of cases of gonorrhea infections and sex, age, and race

$H1_2$: There is a significant relationship between the number of cases of gonorrhea infections and sex, age, and race.

The statistical assumptions for regression analysis were examined prior to completing regression analysis. The existence of a linear relationship was tested using a scatterplot. Figure 7 supports the statistical assumption of a linear relationship. Homoscedasticity was then tested. The existence of homoscedasticity was tested using a scatterplot. Based on Figure 7, there is evidence supporting the assumption of homoscedasticity as present in the regression model.

Figure 8

Regression Standardized Residuals and Predicted Values for Variables in RQ2



The statistical assumption of multivariate normality was tested using a histogram (Figure 8). The findings from the histogram support the existence of multivariate normality. Autocorrelation was then tested. Autocorrelation, or independence, was examined using the Durbin-Watson test. The findings include *D-W* = 0.05. As an acceptable *D-W* statistic is 1.5 < *D-W* < 2.5, the assumptions test for autocorrelation failed. Last, the assumption of multicollinearity. The assumption of little to no multicollinearity failed (Table 7). The assumption failed based on the VIF and tolerance scores for the variables for unknown as Hispanic and Unknown race (*VIF* = 13.35 and 13.35, respectively). Therefore, there is multicollinearity and autocorrelation, violating two assumptions of multiple regression analysis.

Figure 9

Standardized Residuals for the Regression Model for RQ2

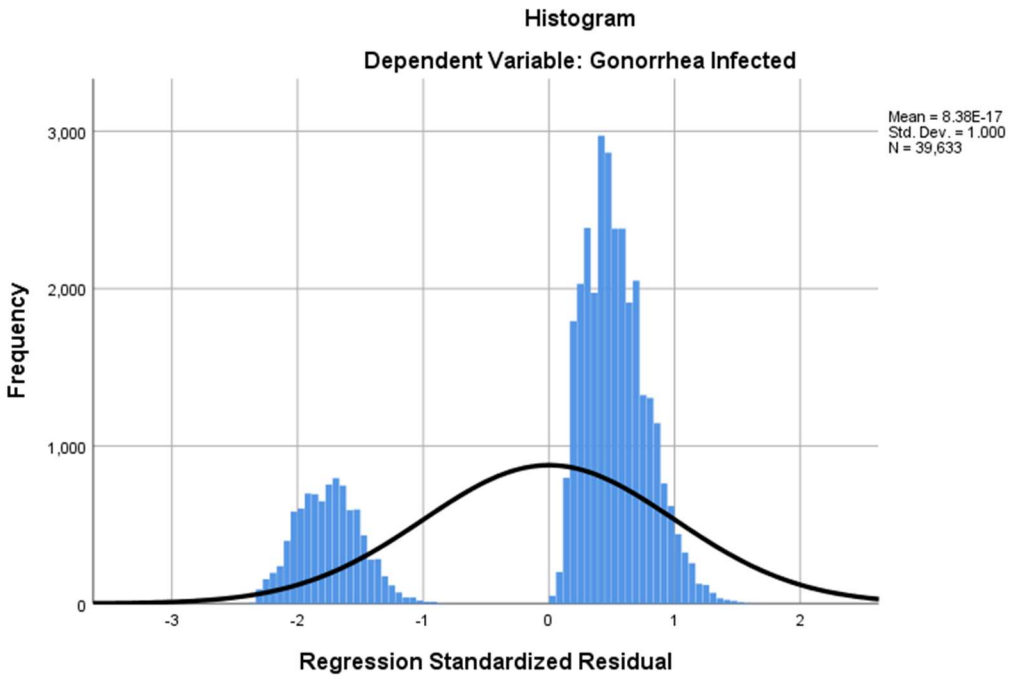


Table 6 includes the model coefficients for Research Question 2. Each predictor variable was significant at $p < 0.05$, except for the predictor of unknown race (0.00). Table 5 includes the model summary for the regression model testing the relationship between age, race, and assigned sex as predictors of gonorrhea infection. The model summary includes findings indicating the model is significant at $p < 0.05$ (sig. = 0.00). Based on the findings a lower age (B = -0.03, sig. = 0.00), female gender (B = 0.64, sig. = 0.00), and being of Unknown Hispanic status (B = -0.86, sig. = 0.00) are characteristics that are significantly related to gonorrhea infection.

The findings are evidence that, like in Research Question 1, the status of an individual as Unknown as Hispanic Yes or No was the strongest predictor and negative

(B = -0.86). The finding is evidence that being unknown as Hispanic was the strongest predictor of being found negative of Gonorrhea. Birth sex, like in the case of Chlamydia, was the second strongest predictor in the model, but unlike in the case of Chlamydia, the predictive strength is positive (B = 0.64). The findings are evidence that being male was associated with being found positive with gonorrhea. Also, unlike in the of chlamydia, the predictive strength of age was negative for gonorrhea infection status (B = -0.03). The higher someone's age, the less likely they would be positive with gonorrhea.

Table 5

Regression Model Coefficients for RQ2

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-0.03	0.00	597.57	1.00	0.00	0.97
Birth Sex	0.64	0.03	618.00	1.00	0.00	1.89
Hispanic Yes or No	0.25	0.04	47.38	1.00	0.00	1.29
Unknown as Hispanic Yes or No	-0.86	0.11	59.46	1.00	0.00	0.43
Black Yes or No	0.51	0.05	87.07	1.00	0.00	1.66
White Yes or No	-0.04	0.04	0.85	1.00	0.36	0.96
Unknown Race Yes or No	0.44	0.11	16.16	1.00	0.00	1.55
Constant	0.48	0.28	2.94	1.00	0.09	1.62

Note: Dependent Variable: Gonorrhea infection status.

RQ3

RQ3: What is the relationship between the number of cases of syphilis infections and sex, age, and race?

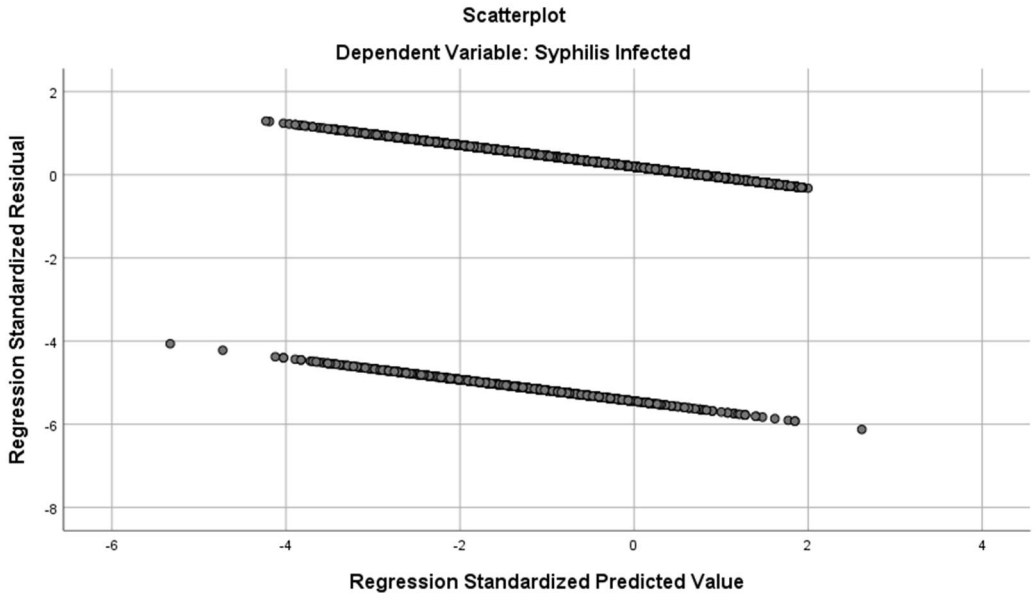
$H0_3$: There is no significant relationship between the number of cases of syphilis infections and sex, age, and race.

$H1_3$: There is a significant relationship between the number of cases of syphilis infections and sex, age, and race.

Multiple regression was selected to test the relationship between sex, age, and race as predictors of the criterion variable of syphilis infection status. Prior to completing regression analysis, the statistical assumptions for regression analysis must be examined. The existence of a linear relationship was tested using a scatterplot. Figure 9 supports the statistical assumption of a linear relationship. Homoscedasticity was then tested. The existence of homoscedasticity was tested using a scatterplot. Based on Figure 9, there is evidence supporting the assumption of homoscedasticity as present in the regression model.

Figure 10

Regression Standardized Residuals and Predicted Values for Variables in RQ3



The statistical assumption of multivariate normality was tested using a histogram (Figure 10). The findings from the histogram support the existence of multivariate normality. Autocorrelation was then tested. Autocorrelation, or independence, was examined using the Durbin-Watson test. The findings include *D-W* = 0.70. As an acceptable *D-W* statistic is 1.5 < *D-W* < 2.5, the assumptions test for autocorrelation failed. Last, the assumption of multicollinearity. The assumption of little to no multicollinearity failed (Table 9). The assumption failed based on the VIF and tolerance scores for the variables for unknown as Hispanic and Unknown race (*VIF* = 13.35 and 13.35, respectively). Therefore, there is multicollinearity and autocorrelation, violating two assumptions of multiple regression analysis.

Figure 11

Standardized Residuals for the Regression Model for RQ3

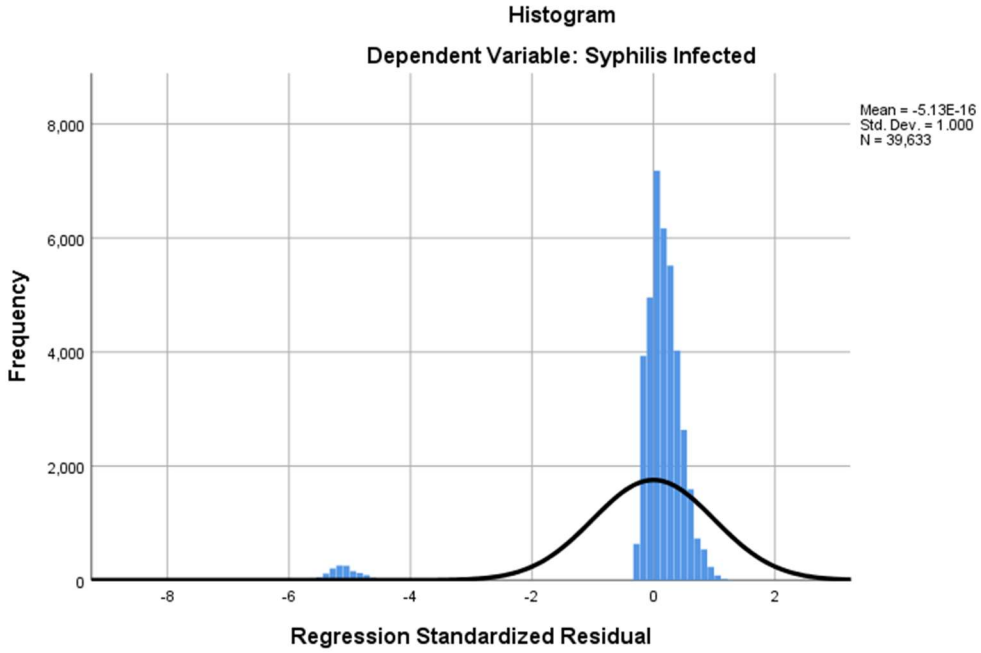


Table 7 includes the model coefficients for Research Question 3. Each predictor variable was significant at $p < 0.05$, except for the predictor of unknown race (0.00). Table 5 includes the model summary for the regression model testing the relationship between age, race, and assigned sex as predictors of gonorrhea infection. The model summary includes findings indicating the model is significant at $p < 0.05$ (sig. = 0.00). Based on the findings a lower age (B = -0.15, sig. = 0.00), female gender (B = 1.38, sig. = 0.00), and being a Black individual (B = 1.15, sig. = 0.00) are characteristics that are significantly related to syphilis infection. The model for syphilis prediction is the model with the factors holding the greatest strength. Race/ethnicity generally held the greatest strength in the model. Not being unknown as Hispanic had the greatest strength as a predictor of positive status for syphilis, as the effect was negative (B = -3.02). This was followed by being an Unknown Race (B = 2.03), White (B = 1.39), and Black (B = 1.15) for race/ethnicity, with being Hispanic as the least strongest predictor of race/ethnicity (B = 0.73), as all the effects were positive. A higher age (B = -0.06) and a birth sex of male (B = 1.38) were both predictors of a positive syphilis status.

Table 6

Regression Model Coefficients for RQ3

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-0.06	0.00	558.33	1.00	0.00	0.94
Birth Sex	1.38	0.08	335.58	1.00	0.00	3.98
Hispanic Yes or No	0.73	0.07	115.94	1.00	0.00	2.08
Unknown as Hispanic Yes or No	-3.02	0.35	76.02	1.00	0.00	0.05
Black Yes or No	1.15	0.14	65.10	1.00	0.00	3.15
White Yes or No	1.39	0.12	144.14	1.00	0.00	4.01
Unknown Race Yes or No	2.03	0.34	35.84	1.00	0.00	7.61
Constant	-0.29	0.73	0.16	1.00	0.69	0.75

Dependent Variable: Syphilis infection status.

Chapter 5: Discussion, Recommendations, and Conclusion

Healthcare services support public health, supply individual healthcare needs, and address public education to prevent adverse outcomes (Blair et al., 2020; Deziel et al., 2018). Healthcare services are also critical in ensuring that individuals are educated regarding the importance of protecting against STIs (Blair et al., 2020). Regardless of the efforts of healthcare industries, STIs, specifically chlamydia, syphilis, and gonorrhea, are prevalent amongst specific demographic categories. Data indicated that a lack of treatment and identification of STIs can result in long-lasting outcomes for individuals, sexual partners, and potentially unborn children (Blair et al., 2020; CDC, 2014; Cecere & Jones, 2014; Kularatne et al., 2018). Ultimately, addressing interventions through demographic targeting can improve public health in the United States (Blair et al., 2020; Deziel et al., 2018).

The specific problem addressed in this study was that it remained unclear the relationship between, chlamydia, gonorrhea, and syphilis, and race, gender, and age among infected individuals in the United States (see Blair et al., 2020; Deziel et al., 2018). To address this problem, I used a quantitative correlational design to examine the relationship between different chlamydia, gonorrhea, and syphilis, and race, gender, and age in the United States. Addressing this problem provided information that can support interventions designed to address the spread of diseases within specific communities, develop a renewed understanding of potential prevention techniques, and improve empirical literature understanding regarding STI transition amongst differing

demographics in the United States. The following research questions were posed to address the purpose of the quantitative correlational design:

- RQ1: What is the relationship between the number of cases of chlamydia infections and sex, age, and race?
- RQ2: What is the relationship between the number of cases of gonorrhea infections and sex, age, and race?
- RQ3: What is the relationship between the number of cases of syphilis infections and sex, age, and race?

In the following sections, each of these research questions is addressed by consideration of the research findings presented in Chapter 4. In this chapter, I present the study findings through consideration of empirical research. Additionally, the research findings are discussed concerning the guiding research questions. Data is supplied regarding the relationship between the findings and practice and research recommendations. The limitations of the study regarding design and methods are reviewed. Recommendations for future studies are presented based on the findings delineated within Chapter 4. Finally, the findings' implications in research and practice are discussed. Chapter 5 is concluded with a summary.

Discussion of Study Findings

Data was collected from individuals in the state of Colorado treated for gonorrhea, syphilis, or chlamydia. Secondary data was collected from the Colorado Department of Public Health and Environment. The data set included surveillance profiles from 2019 data covering gonorrhea, syphilis, and chlamydia. Age, sex, and race

were included in the database. Individual-level data was the only data included in the data set. In this section, the findings discussed in chapter four are presented through consideration of previous empirical and theoretical literature. First, I discuss the statistical findings specific to the target population in relationship to each research question. I then discuss the findings, significance, and implications.

RQ1

The statistical findings regarding the relationship between chlamydia infection, race, age, and sex support previous information regarding the importance of producing chlamydia prevalence by identifying potential groups at higher risks for the purpose of intervention targeting (see Batteiger et al., 2019; Lochner & Maraqa, 2018). Infection with chlamydia carries an elevated risk of creating adverse medical outcomes for pregnant women and unborn children (CDC, 2015; Lochner & Maraqa, 2018; Mishori et al., 2012). Identifying potential interventions for the individuals at a high risk may support the reduction of chlamydia infection and reduce the potential adverse outcomes associated with infection from individuals or sexual partners.

The first research question examined the relationship, if any, between the number of cases of chlamydia infections and sex, age, and race. In terms of age, when chlamydia infection is the focus, rather than chlamydia, gonorrhea, and syphilis together, there is evidence of the highest mean age belonging to individuals assigned male at birth (M = 27.49, SD = 9.16). In contrast, the lowest mean age belonged to individuals assigned female at birth (M = 23.50, SD = 6.94). While race and Hispanic status appeared to have mean scores clustered in the 25-26 years of age range, the age range for individuals only

reporting a chlamydia infection was generally clustered in the 24-25 age range. The findings of logistic regression analysis demonstrated that a higher age (B = 0.05, sig. = 0.00) is significantly related to chlamydia infection. The findings corroborate previous research that indicated that more chlamydia infections occur within the 22–24-year-old group (see Kissinger, 2014; Trivedi et al., 2018). The identified findings in this study are significant as they may improve upon interventions targeted towards higher age ranges to reduce chlamydia infection amongst individuals and potential sexual partners.

Regarding sex, individuals assigned female at birth had a higher frequency of infection (*n* = 22,156) than individuals assigned male at birth (*n* = 17,477). Individuals assigned female at birth had a higher frequency of infection (*n* = 18,179) than individuals assigned male at birth (*n* = 10,807). The logistic regression report stated male gender (B = -0.79, sig. = 0.00) are characteristics that are significantly related to chlamydia infection. Data from Blair et al. (2020) and Kularatne et al. (2018) indicated that individuals assigned male at birth are often more likely to contract and spread chlamydia. The research of this study illustrated that the assigned male gender is related to chlamydia infection, which corroborates previous empirical data (see Blair et al., 2020; Kularatne et al., 2018; Marotta, 2017).

Referencing race, the most frequent case count was among White participants (*n*= 10,951), while the least frequent was among Black participants (*n* = 2,862). Within the scope of Hispanic status, individuals reporting as non-Hispanic had the highest frequency (*n* = 11,409), while Hispanics had the lowest count (*n*= 6,470). Logistic regression indicated that not being of Unknown Hispanic status (B = 0.97, sig. = 0.00) and not

being of other races (B = 0.11, sig. = 0.00) are characteristics that are significantly related to chlamydia infection. Previous data argued that African American populations are at an increased risk of contracting chlamydia (Blair et al., 2020; CDC, 2015; Kularatne et al., 2018; Marotta, 2017). However, the current study illustrated that racial status as not being of unknown Hispanic status (B = 0.97, sig. = 0.00) and not being of another race are characteristics that are significantly related to chlamydia infection. In contrast to previous research, the findings demonstrate a need to focus on this racial group to improve interventions that would support overcoming potential infection and spread of chlamydia.

To summarize, logistic regression was selected to evaluate the relationship between sex, age, and race as predictors of the criterion variable of chlamydia infection status. A higher age (B = 0.05, sig. = 0.00), male gender (B = -0.79, sig. = 0.00), not being of unknown Hispanic status (B = 0.97, sig. = 0.00), and not being of other race (B = 0.58, sig. = 0.00) are characteristics that are significantly related to chlamydia infection. Data from Trivedia et al. (2018) and Kissinger (2014) indicated that increasing screening programs and interventions based on demographics and potentially addressing the need to reduce infection rates marks individuals and sexual partners. Data regarding age, race, and sex in this study further emphasized the importance of understanding demographic relationships with chlamydia infection.

RQ2

The second research question examined the relationship between the number of cases of gonorrhea infections and sex, age, and race. Researchers reported that gonorrhea

is the second most reported STI in the United States (CDC, 2015; Mayor et al., 2012). Gonorrhea amongst women is often asymptomatic, while men are symptomatic, though some may present asymptomatic cases (CDC, 2015). Determination of infection rates can significantly improve interventions, spread prevention, and outcomes for infected individuals in terms of the personal health and health of their sexual partners and unborn children (Mayor et al., 2012). The national rate of gonorrhea infection has fluctuated across the past two decades; however, the infection can lead to significant complications among both men and women (CDC, 2015; Mayor et al., 2012).

The descriptive statistics indicated that among the examined data set, White individuals (n = 16,056), while the least frequent was among Black participants (n = 4,658). Within the scope of Hispanic status, individuals reporting as non-Hispanic had the highest frequency (n = 16,787). In contrast, Hispanics had the lowest count (n = 9,330) and were most likely to report cases of gonorrhea infection. The logistic regression model also indicated that being of unknown Hispanic status (B = -0.86, sig. = 0.00) are characteristics that are significantly related to gonorrhea infection. Previous researchers also demonstrated a higher rate of gonorrhea infection among African American populations (Batteiger et al., 2019; Habel et al., 2018; Kularatne et al., 2018; Marotta, 2017). In this study, the findings conversely indicated that being of unknown Hispanic status (B = -0.86, sig. = 0.00) are characteristics that are significantly related to gonorrhea infection. Thus, providing new information to aid in intervention development. Further, researchers indicated the importance of addressing this infection rate amongst the specific demographic to prevent the spread and adverse outcomes upon sexual

partners (Batteiger et al., 2019; Kularatne et al., 2018; Marotta, 2017). Improving upon previous research, the current study demonstrated the increased risk of unknown Hispanic status populations contracting gonorrhea infection. These findings indicated the importance of focusing on unknown Hispanic status populations to support interventional aid and prevention of gonorrhea infection.

In terms of sex, individuals assigned female at birth had a higher frequency of infection (n = 22,156) than individuals assigned male at birth (n= 17,477). The regression model indicated that the female gender (B = 0.64, sig. = 0.00) is a characteristic that is significantly related to gonorrhea infection. These findings corroborate the research of Cha et al. (2017) and Lochner and Maraqa (2018), who indicated an increased risk of chlamydia infection among females. Data in this study illustrated a preponderance of cases found amongst female populations, which may require further examination from future researchers to ensure proper interventions are developed for this demographic.

Regarding age, the highest mean age was for males (M = 29.15, SD = 10.01), and the lowest was for females (M = 24.03, SD = 7.40). The logistic regression model indicated that a lower age (B = -0.03, sig. = 0.00) was significant for gonorrhea infection. Previous researchers indicated the likelihood of gonorrhea infection amongst 30- to 34-year-old women increased over the age of 35 years. I found an increase in potential infection rate amongst the 20 to 24 age group, with the lower age holding a higher risk of gonorrhea infection (see Gregory & Ely, 2020). Thus, indicating the need for differential interventions to address this potential infection rate amongst these higher age groups to

prevent the spread and likelihood of adverse health outcomes associated with gonorrhea infection.

The identified information in this study illustrates the importance of focusing on differential demographics regarding gonorrhea infection prevention, education, and awareness. In sum, concerning the logistic regression model, a lower age (B = -0.03, sig. = 0.00), female gender (B = 0.64, sig. = 0.00), and being of unknown Hispanic status (B = -0.86, sig. = 0.00) are characteristics that are significantly related to gonorrhea infection. The reviewed data indicated the need to develop interventions to address this population to support prevention and develop awareness. Furthermore, these findings both confirm previous data regarding assigned females at birth risk (see Gregory & Ely, 2020) and expand upon the need to focus on race as unknown Hispanic status and lower-aged population demographics.

RQ3

The third research question examined the relationship between the number of cases of syphilis infections and sex, age, and race. Syphilis infection significantly impacts infected female patients, specifically pregnant women (Cha et al., 2017; Kimball et al., 2020; Trivedi et al., 2018). Researchers argued that treatment and prevention of syphilis infection could prevent potential adverse perineal outcomes (Cha et al., 2017). While syphilis rates have reduced significantly in the past 3 decades, a potential rise in congenital syphilis is evident among some demographic women (Cha et al., 2017; Kimball et al., 2020; Trivedi et al., 2018). Ultimately, congenital syphilis cases can lead to miscarriages, infant death, stillbirth, or lifelong physical and neurological problems.

Ultimately, preventing syphilis infection by targeting specific demographics can positively impact individual population health.

In terms of age, the mean age for individuals who are assigned male at birth (M = 36.12, SD = 11.93) is higher than that of individuals assigned female at birth (M = 30.85, SD = 9.70), there are mean ages lower and higher than those of individuals by assigned sex. The lowest mean age was within the category of race and was other (M = 29.64, SD = 8.81), while the highest mean age was in the category of Hispanic status and was based on individuals who were not Hispanic (M = 36.82, SD = 12.28). These findings are evidence of syphilis following different trends than chlamydia and gonorrhea. The findings of the logistic regression analysis of a lower age (B = -0.15, sig. = 0.00) are characteristics that are significantly related to syphilis infection. Gregory and Ely (2020) indicated an increased risk of syphilis detection among women of maternal aged 30 to 35 years old how. However, syphilis infection risk increased for women aged 35 and over. Similarly, to Gregory and Ely, Stanford et al. (2021) indicated an increased risk of syphilis as age progressed. The findings in this study expanded upon previous research by identifying a need for addressing the lower age groups in terms of assessing prevention for syphilis prevention. Compared to the 55+ age group, lower aged demographics amongst assigned females at birth and assigned males at birth are more likely to develop cases of syphilis. The data from this study indicated the need for interventions to address these age groups, alongside other demographic factors, to improve upon treatment, prevention, and awareness of syphilis infection.

Regarding sex, individuals assigned male at birth had a much higher frequency (*n* = 1,138) than individuals assigned female at birth (*n*= 239). The size of the difference in frequency is remarkable and serves as evidence of a greater frequency of White males infected with syphilis in the sample. The logistic regression indicated female gender (B = 0.10, sig. = 0.00) are characteristics that are significantly related to syphilis infection. These findings corroborate previous research that indicates the prevalence of syphilis is highest amongst women. Research from Cha et al. (2017) and Trivedi et al. (2018) indicated an increased risk for women experiencing said it was an infection. Additionally, Cha et al. (2017) found that pregnant women were more likely to develop syphilis which results in negative health effects on the unborn child. Thus, the current study confirmed that assigned gender as female at birth is associated with an increased risk of contracting syphilis. As such, these findings indicate the importance of targeting intervention, awareness, and prevention of the spread amongst assigned females at birth in terms of interventions regarding syphilis infection, education, and prevention.

In terms of race, individuals whose race was reported as White had a higher frequency of syphilis infection than individuals of other races (*n*= 1,029). The frequency observed is much higher than the other races. The logistic regression analysis resulted in demonstrating that being a Black individual (B = 1.15, sig. = 0.00) is a characteristic that is significantly related to syphilis infection. Data from Trivedi et al. (2018) also identified an increased risk of syphilis reports among Indigenous people, non-Hispanic whites, and Hispanics. However, Gregory and Ely (2020) identified a higher risk of STI development, specifically syphilis, amongst non-Hispanic Black women. In this study,

the increased risk was amongst African American populations. Thus, indicating the need for interventions that focus on African American and White populations, the two most significantly affected groups within this study.

To summarize, a lower age (B = -0.06, sig. = 0.00), female gender (B = 1.38, sig. = 0.00), and being a Black individual (β = 1.15, sig. = 0.00) are characteristics that are significantly related to syphilis infection. In addition, the identified evidence also showed that syphilis follows differential trends than chlamydia and gonorrhea, which may aid intervention specialists and practitioners. Thus, the findings specific to syphilis indicate the need for improved interventions to address these demographics identified as holding demographic characteristics associated with a significant risk of syphilis infection.

Limitations of the Study

The first limitation of this study was that the Durbin-Watson statistics for each model indicated the assumptions of independence were violated. The limitation of this summation indicated that further information is required from a similar or larger sample to assess further the relationships between data sets and connections between factors of age, sex, and race. Future researchers may expand upon this study by addressing this limitation and ensuring the assumption of independence is not violated. The second limitation is the VIF, and tolerance statistics indicate a violation of the assumption of multicollinearity. Finally, multicollinearity examines the correlation between explanatory variables (Johnson, 2001). In some cases, the relationship between variables is difficult to distinguish in statistical testing (Johnson, 2001). As such, the researchers suggest future examinations that address this elimination to ensure the assumption of multicollinearity is

not violated. In terms of these limitations, there was a normal distribution of the data per scatter plots, demonstrating the reliability of the findings regarding the significance of logistic regression models and descriptive statistics.

The third limitation is the use of secondary data specific to Colorado. As a result, the information obtained cannot be generalized beyond Colorado, the demographic sample, or a larger national setting. As such, researchers should extend these findings to assess generalizability to larger populations. The use of secondary data sources may also bias the study due to the inability to collect further information regarding internal and external factors that influenced the conditions of collected data. Though this limitation impacts generalizability, the researcher argues that the use of secondary data is a valid method for understanding information specific to the populations that have obtained diagnoses for syphilis, gonorrhea, and chlamydia. Based on these limitations, recommendations are supplied for future researchers in the following section.

Recommendations For Future Studies

In this section, the researcher discussed his recommendations for future studies. The recommendations demonstrate the importance of expanding the sample size and improving generalizability. The researcher also emphasizes the importance of considering individual factors and future research to understand potential indicators that increase the likelihood of diagnosing syphilis, chlamydia, and gonorrhea.

Expand Sample Size

The first recommendation for future studies is to expand upon the current sample size to address statistical limitations. As the researcher noted, evidence existed for a

slight violation of multicollinearity. Additionally, evidence existed for rejecting the assumption of independence. Expansion of the sample size would address such limitations. Following this recommendation may provide additional information that will supply data required for targeting specific populations to prevent the spread and improve awareness regarding gonorrhea, syphilis, and chlamydia.

Improve Upon Generalizability

The second recommendation is to approve generalizability by expanding upon the current study and differing states or through a national setting. A larger data step would improve generalizability and provide larger conclusions extending from the current sample set context in Colorado. In addition, these findings may prove helpful for future researchers in terms of understanding the need for other studies, interventions, or factors that influence populations' likelihood of contracting a diagnosis of syphilis, chlamydia, or gonorrhea.

Examine Individual Factors that may Influence Diagnosis

The recommendation for future studies is to explore individual factors that may potentially influence the diagnosis of chlamydia, syphilis, or gonorrhea. While understanding larger demographic characteristics can improve upon interventions and spread awareness, it is also important to consider how individual for community factors, such as education, income level, sexual patterns, and parental education status, influence potential diagnoses with STIs. Researchers are recommended to expand upon these findings through either state or national data to understand how individual factors may

influence diagnosis and provide data that influences interventional information for preventing STI spread.

Implications

The current research posed to understand the relationship between age, sex, and race in terms of infection with chlamydia, gonorrhea, and syphilis. Data indicated an increased risk for these STIs among varying demographics when examining infection rates for chlamydia, gonorrhea, and syphilis (Blair et al., 2020; CDC, 2014; Cecere & Jones, 2014; Kularatne et al., 2018). Research questions were posed to understand the relationship between sex, age, and race with chlamydia, gonorrhea, and syphilis infections. In terms of chlamydia, data indicated an increased risk of chlamydia infection amongst demographics pertaining to a higher age male gender, not being of Unknown Hispanic status, and not being of *other* race. These findings indicate the importance of understanding demographic infections as they may differ or align with previous research. Empirical research indicated the likelihood of African American males aged 20-24 years old contracting chlamydia infections (Blair et al., 2020; CDC, 2014; Cecere & Jones, 2014; Kularatne et al., 2018). However, the findings of this study also demonstrate increased risk, secondarily in comparison to African Americans, not being of Unknown Hispanic status and not being of *other* races. These findings are important as they indicate the need to continually focus on multiple demographics for the prevention and awareness spread of chlamydia prevention. Additionally, the data extended upon previous findings demonstrating the increased risk of chlamydia infection amongst a higher age group and those assigned males at birth. The implications of these findings

offer the opportunity for practitioners and researchers to target these populations to prevent the spread, increase awareness, and attempt to prevent adverse outcomes upon sexual partners.

The second research question demonstrated a relationship between gonorrhea infections, sex, age, and race. Notably, the findings demonstrated that lower age, female gender, and being of unknown Hispanic status are significantly related to gonorrhea infection. These findings align with previous research but also illustrated the importance of focusing on lower age, female assigned sex at birth, and status as unknown Hispanic race. Future researchers should explore how specific individual factors mediate demographics to develop appropriate interventions designed to prevent, educate, and increase awareness amongst individuals and sexual partners.

The third research question demonstrated a relationship between cases of syphilis infection, sex, age, and race. Specifically, in this study, a lower age, female gender, and being a Black individual are significantly related to syphilis infection. These findings emphasized the importance of understanding the contextual factors contributing to the demographic's likelihood of developing syphilis infections. These findings illustrate the importance of examining Black females assigned at birth and lower-aged demographics for syphilis interventions and educational prevention strategies. Thus, demonstrating the importance of also considering interventions to address the most significantly impacted population. The research findings may be used to develop interventions, improve education, and spread awareness regarding the adverse health effects of syphilis infection.

Conclusion

In this study, the researcher addressed the problem that was not clear regarding the relationships between different types of STI infection, specifically chlamydia, gonorrhea, and syphilis, with age, race, and gender. The researcher addressed the purpose of this study to investigate the relationship between different types of SDI infection trauma, specifically race, gender, and age, among affected people in the US who have or were undergoing treatment for chlamydia, gonorrhea, and syphilis. Participants included in this study were individuals and Colorado infected with STIs in the US. A quantitative correlational research design was used for the study. Data were assessed using logistic regression analysis following SPSS software guidance. A total of three research questions were posed regarding the relationship between age, gender, race, and infection with syphilis, chlamydia, and gonorrhea.

The findings of this study demonstrated relationships between age, sex, and race in terms of infection with chlamydia, gonorrhea, and syphilis. Data indicates, specific to chlamydia, increased risk of infection amongst a higher age, male gender, not being of Unknown Hispanic status, and not being of other race were more likely to undergo treatment. In terms of gonorrhea, a lower age, female gender, and being of unknown Hispanic status are characteristics that are significantly related to gonorrhea infection. Regarding syphilis, a lower age, female gender, and being a Black individual are characteristics that are significantly related to infection. The research findings demonstrated the importance of targeting specific demographic characteristics to spread

awareness, educate, and prevent chlamydia, gonorrhea, and syphilis infections among individuals and potential sexual partners.

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