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Drug-resistant Neisseria gonorrhoeae; Identification of At-Risk Groups in Florida by Regional Variation

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Abstract

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by

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MS, Nova Southeastern University, 2001

BA, Kutztown University, 1993

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Neisseria gonorrhoeae has been on the rise in the State of Florida since 2013. Florida currently follows the Centers for Disease Control and Prevention guidelines for identifying those at-risk for gonorrhea and drug resistant gonorrhea infections. These groups are narrowly defined and do not consider the different population dynamics throughout the State. This study examined the question of who is at-risk for contracting drug resistant strains of gonorrhea in the eight different regions of Florida based on the prescribed use of last-line-of-antibiotic-defense. Florida's Surveillance Tools and Reporting System provided 12 years of secondary data from 2007 to 2018. The data included 34 risk and demographic variables equaling over 9.5 million data points. The data were analyzed through chi-square, cross tabulation, and multiple logistic regression calculations. The findings indicated that each region had statistically significant unique risk and demographic factors as predictors of drug-resistance. Some of the regions shared similar risk and demographic factors such as age, condom use, and oral sex, with age being the most common factor across most of the regions. Conclusively, the regional findings were not identical to each other, indicating that a uniform application of a statewide intervention is not applicable. These varying factors, most of which are behavioral risk factors, are indicative of the Health Belief Model and the Theory of Reasoned Action. Intervention strategies will need to target specific demographics and risk factors in each region to institute social change and prevent the spread of drug-resistant gonorrhea.

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Dedication

This dissertation is dedicated to all my family, friends, and colleagues who have supported me throughout the journey. Their encouragement and support were my inspiration and driving force to complete this lifelong goal. I can never appreciate them enough.

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Chapter 1: Introduction to the Study

Introduction

Neisseria gonorrhoeae, or more commonly known as gonorrhea, is a pathogenic bacterium that is generally transmitted sexually, but can also be transmitted by other means (Giguère & Alary, 2015). Gonorrhea has been well documented for centuries and was first described by the Greeks in 130 A.D. (Black & Black, 2016). The term gonorrhea in Greek means "flow of seed," indicating that the common form of transmission was sexual (Black & Black, 2016). It was not until 1916, when Albert Ludwig Sigesmund Neisser was able to identify the pathogenic bacterium that caused gonorrhea, hence creating the taxonomic name *Neisseria* (after himself) *gonorrhoeae* (supporting and giving credit to the original Greek name; Black & Black, 2016).

In the United States alone, there are over 800,000 identified cases per year (United States Centers for Disease Control and Prevention (CDC), 2017). Many more cases are not recognized due to the asymptomatic infectious behavior of the bacteria. Most individuals are asymptomatic; thus, they do not seek medical treatment (Maraynes et al., 2017). There are significant risks associated with this infection, including but not limited to, sterility, ectopic pregnancy, increased risk of contracting HIV, and necrosis (CDC, 2017).

Background

There are many publications on the behavior of *Neisseria gonorrhoeae* but no current peer reviewed works on at-risk groups in Florida were identified. This dissertation studied the relationship between the use of last-line-of-antibiotic-defense

treatment as a method of predicting at-risk groups for drug resistant variants of gonorrhea. The following articles support this study. Alirol et al. (2017) published information on the history of drug-resistant gonorrhea and noted that there has been little to no research on the at-risk groups. They discussed the need for more research in this area as well as their anticipation that gonorrhea would become completely drug-resistant in the very near future. Tuite et al. (2017) examined ciprofloxacin, azithromycin, and ceftriaxone antibiotics and their effectiveness on resistant strains of gonorrhea. They claimed that interventions were necessary or else there would soon be incurable strains of gonorrhea. Maraynes et al. (2017) discussed the difficulties of diagnosing cases of gonorrhea due its asymptomatic behavior. Their work supported the position of this dissertation: that the CDC only narrowly and limitedly focuses on at-risk groups on a national level and does not take into consideration regional differences. They supported a more targeted approach and the identification of the regional at-risk groups for effective interventions.

Kirkcaldy (2016) published the most current surveillance information on gonorrhea from limited locations. There are only 27 clinical sites across the United States that monitor for drug-resistant strains of gonorrhea and, due to financial restraints, not every individual is tested for drug resistance. Only those who fall under the CDC criteria are tested. This indicates that regional data collection is not occurring, and thus creating a gap in data as well as potentially misdirecting intervention strategies. The sites were chosen to detect changes in antimicrobial sensitivity across a wide range of national

geographies and was not designed to be nationally representative. This suggests a need for more targeted regional approaches.

Whiley et al. (2012) placed emphasis on the concern that it is only a matter of time before gonorrhea becomes completely drug resistant. They also emphasized the need for more research, and that a targeted approach will be necessary to intervene in the evolution of drug resistance. Giguère and Alary (2015) and Grad et al. (2015) discussed the importance of identifying and targeting specific groups. They sought to stop the spread of drug-resistant gonorrhea. In their publications, they referred to these at-risk groups as core groups, but on a worldwide scale. These core groups, as they have defined are risky behavior, repeatedly infected, and sex workers. There was no identification or discussion how to identify at-risk groups on a localized scale. National demographics may vary from localized demographics; identifying at-risk groups at the local scale would be of greater benefit and significantly more effective.

Problem Statement

Over the last 50 years there have been a variety of ever-changing medications to treat gonorrhea (CDC, 2017). Unfortunately, due to the organism's ability to adapt, all but one of those treatment plans are now useless (Alirol et al., 2017; CDC, 2017; Kirkcaldy, 2016). This bacterium is rapidly evolving to become drug-resistant and the CDC stated in 2017 that this last drug treatment option will not last (CDC, 2017). The CDC has stated that drug-resistant gonorrhea is now an urgent public health issue (CDC, 2017). There were many predictions beginning in 2015, that it would become drug-resistant within as little time as this decade (Grad et al., 2015). Unfortunately, those

predictions were correct and in March 2018, the first identified case of completely drug-resistant gonorrhea appeared in a British male in the United Kingdom (Bello, 2018). Although not completely drug resistant, in January 2019 two unrelated British women, contracted variants that are resistant to the current prescribed recommended antimicrobial treatments, indicating the progression to full drug resistance is nearing (Gallagher, 2019).

Although proclaimed as a major public health issue by the CDC, Florida has done little to bring it to the attention of its citizens. Currently, Florida's at-risk groups are the same as those recommended by the CDC: men having sex with men, sex workers, and pregnant women (CDC, 2017; 2018). Considering the vast variation in Florida's demographics, these three groups are too narrow ranging and do not take into consideration regional demographics. Florida's demographics are not evenly distributed across the state. The demographical groups are concentrated in the different regions, primarily due to historical events, immigration, and migration patterns. The details of the demographic variations within Florida, is discussed in detail in Chapter 2.

Purpose of the Study

The purpose of this quantitative study was to identify the at-risk groups per Florida region that are most likely to contract drug-resistant gonorrhea. Within the eight Florida regions, there is a significant informational gap on those who are at-risk for contracting gonorrhea and drug-resistant gonorrhea. Florida and CDC identify narrow ranging at-risk groups that are vulnerable for contracting gonorrhea and drug-resistant gonorrhea. The state does not focus on the regional demographics. In Florida, the demographics vary by county and region. These vast cultural differences can contribute

to the progression of sexually transmitted diseases because varying cultures view sexual behaviors differently (Trecker & Dillon, 2014; Trecker et al., 2015). This dissertation expands the currently limited demographical knowledge of infected groups, predicts potential at-risk groups for drug-resistant gonorrhea, and creates a knowledge foundation with which to develop targeted interventions.

Research Questions and Hypotheses

This study identified the at-risk groups for contracting drug-resistant gonorrhea on a regional basis in Florida by evaluating (a) the currently prescribed last line of antibiotic treatments and (b) the gonococcal infection risk factors. To fulfill the intention of this study, the following questions were answered using secondary data provided by the State of Florida.

Research Question 1: Are there differences in using last-line-of-antibiotic-defense between Florida as a whole and each of the eight regions?

Research Question 2: Are there differences in using last-line-of-antibiotic-defense among the eight Florida regions?

Research Question 3: What are the statistically significant factors associated with being treated with last-line-of-antibiotic-defense in each of the eight regions and the state of Florida?

Theoretical Framework

This dissertation fits well within the 1966 health belief model (HBM) and the 1975 theory of reasoned action (TRA). The HBM is based on four basic principles: (1) perceived susceptibility, which means how a person perceives how much at risk there is

for contracting the infection; (2) perceived severity, or how serious the consequences are; (3) perceived barriers, such as what would interfere with or facilitate adoption; and (4) perceived cost of dealing with an intervention (Rosenstock, 1974). With TRA, the individual considers the consequences of their behavior before engaging in that behavior (Ajzen, 1985). Currently the World Health Organization (WHO) and the CDC identify the at-risk groups as sex workers, pregnant women, and men who have sex with men (CDC, 2018). This leaves out a large number of other demographic groups, such as heterosexuals, bisexuals, age ranges, and ethnic. Based on the HBM and TRA models, many other groups may be at-risk because they do not believe they fit into one of the proposed categories. Considering the many different demographics across the regions of Florida, there are individuals who do not fit into the narrower reaching categories as currently defined. Thus, the individuals may continue risky behavior, thinking they are not at risk. This means it is necessary to identify the at-risk groups on a directed scale, so that targeted interventions can be created.

Giguère and Alary (2015) and Grad et al. (2015) established models for identifying at-risk groups on a global scale, based on behavior or antibiotic resistance. They used existing large-scale data to focus their model on targeted core groups. Their core groups have some similarities to the identified core groups, which the CDC have also identified. All of the current models look at global or national applications. The models created by Giguère and Alary (2015) and Grad et al. (2015) could be modified for use on a more regionalized scale, as this dissertation sought to do.

Nature of the Study

This study examined the relationship between gonorrhea infections and causes. A quantitative study using government-provided secondary data was conducted. Florida and the Federal government collect gonorrhea infection data, because gonorrhea infections are mandated as a reportable disease (CDC, 2012). Using secondary data from a government source indicated that the information has already been vetted and passed at least one institutional review board (IRB) prior to collection. Use of the secondary data required further IRB approvals. Additionally, to collect the amount of data that was needed to complete this dissertation as primary data, was cost prohibitive. There was no guarantee that grant monies would be successfully obtained at all or within the timeframe to conduct this study. Thus, using existing government data was the most logical approach. To successfully predict which risk and demographic factors by region were most likely to acquire drug-resistant gonorrhea infections, statistical evaluations were conducted. Thus, a quantitative approach was the strongest method to generate the findings.

Types and Sources of Data

There were limited databases available for demographic factors, risk factors, and prescribed last-line-of-antibiotic-defense treatments for Florida. To obtain this information, the following two databases were used:

1. Florida's Surveillance Tools and Reporting System (STARS) is a 20-year database consisting of 78 risk-behavior data entries, additional associated demographics, and prescribed modes of treatment with the infection. As a

reportable disease, gonorrhea was in the database. However, such cases are reported only if the individual has been medically diagnosed as positively infected with the bacterium. Access to this database was provided upon execution of a signed data use agreement (agreement number 2019-082).

2. Within the Florida Community Health Assessment Resource Tool Set (CHARTS) system, information was limited to ethnic, sex, age, and location. This information was used as a basis for targeted data mining.

Definitions

Age-range: Age group that an individual fall within (CDC, 2016b and FDOH, 2018).

Always used condoms: Individual always used a condom during a sexual act (FDOH, 2018).

Anonymous partner: Sex with and unknown individual (FDOH, 2018).

Condom use with main partner: Using a condom with the partner who is considered the primary individual in the relationship (FDOH, 2018).

Condom use with other partner: Using a condom with an individual not considered as the primary individual in the relationship (FDOH, 2018).

Drug use: Using legal or illegal drugs or medicine (FDOH, 2018).

Ethnic: Cultural factors including local culture, ancestry, nationality, and language (CDC, 1993).

Gender: The gender that an individual identifies themselves as (CDC, 2017).

Had a history of a STD: The individual had a STD prior to the current infection (FDOH, 2018).

Had an STD in the last 12 months: The individual had a STD in the 12 months prior to the current infection (FDOH, 2018).

Incarcerated in the last 12 months: Has been incarcerated within the 12 months prior to the current infection (FDOH, 2018).

Initial antibiotic treatment: Medical intervention utilized by licensed medical doctors to treat gonococcal infections (Hook III, Shafer, Deal, Kirkcaldy, & Iskande, 2013).

Intoxicated Alcohol or Drugs: Individual was either using alcohol or drugs at the time of being infected (FDOH, 2018).

Knew self-HIV status: Individual who knows their HIV status at the time of the infection (FDOH, 2018).

Meet through the internet: Individual meet sex partner through the internet (FDOH, 2018).

Men having sex with men: Biological male having sex with another biological male regardless of their sexual orientation (FDOH, 2018).

Met partner in bar: Individual meet sex partner in a bar (FDOH, 2018).

Meet partner in bath: Individual meet sex partner in a bathhouse (FDOH, 2018).

Never used condom: Individual who never uses a condom during a sex act (FDOH, 2018).

New Partner in last 90 days: Individual has sex with a new partner that they have know for 90 day or less (FDOH, 2018).

Number of Sex Partners: Total number of sexual partners listed on the interview (FDOH, 2018).

Oral sex with a man: Individual had oral sex with a man regardless of sexual orientation (FDOH, 2018).

Oral sex with a woman: Individual had oral sex with a woman regardless of sexual orientation (FDOH, 2018).

Paid for sex: Individual gave drugs, money, or something in exchange for sex (FDOH, 2018).

Pregnancy: A pregnant female at the time of the infection (FDOH, 2018).

Race: An individual's physical characteristics such as skin color, hair color, eye color, and bone structure (CDC, 1993).

Region: Area of Florida consisting of a group of counties (Gaglioti et al., 2018).

Risk factor: A condition, behavior, or other factor that increases the risk of contracting gonococcal infections (CDC, 2017; Kirkcaldy, 2016).

Self-reported gender: The gender that an individual identifies themselves as (CDC, 2017).

Sexual Assault: An individual who was a victim of sexual assault (FDOH, 2018).

Sexual orientation: A person's sexual identity in relation to the gender in which they are attracted to (CDC, 2017).

Sometimes used condoms: Individual who did not regularly use condoms (FDOH, 2018).

State: Refers to the state of Florida.

Unprotected sex with man: Sex with a male without protective barriers (Giguère, K.et al., 2019).

Unprotected sex with woman: Sex with a female without protective barriers (Giguère, K.et al., 2019).

Vaginal or anal sex with man: Sex with a male either vaginally or anally regardless of sexual orientation (FDOH, 2018).

Vaginal or anal sex with woman: Sex with a female either vaginally or anally regardless of the sexual orientation (FDOH, 2018).

Was paid for sex: Individual who received drugs, money, or something in exchange for sex (FDOH, 2018).

Assumptions

Within this study it was assumed that the secondary data were collected correctly, and that the data were true and complete. Gonorrhea is a reportable disease in Florida and at the Federal level (CDC, 2012). The information originates from the health care provider or a designee. Due to the many different individuals who may be entering the information there is no guarantee that the data were entered correctly or completely.

It is also assumed that not all cases of gonorrhea in Florida were reported. It was assumed that in some instances, a medical professional, in protecting the interests of their patients, may have omitted information or not reported the infection at all. Even if some medical professionals failed to report, the information reported was considered a representative group of identified cases in each region. Another reason for this assumption was that gonorrhea has asymptomatic behavior characteristics (Maraynes et al., 2017). Thus, many cases remain undetected and unreported. The number of unreported cases is unknown, although there have been many estimates that the actual

cases are significantly higher than what has been reported (CDC, 2017). It was assumed that the unreported cases would follow the same demographic infectious trends as the reported cases, thus the data that was available was considered representative of all cases.

Scope and Delimitations

Although the HBM and TRA fits this study well, there is still a lack of regional specific information to the public. This lack of information inhibits individuals from making informed health related choices. It was conjectured that the level of behavioral driven susceptibility is associated to an appropriate level of knowledge base. This study was not intended to answer all the possible questions that may arise, but it was intended to gain a better understanding of at-risk groups on a regional basis. This then established a foundation for future interventions and continued research in the areas of disease prevention.

Limitations

This study used the guiding tenets of the HBM and TRA with a focus on those perceived at-risk for drug resistant gonorrhea. The data for this study were secondary and provided by FDOH. The study was limited to the data available and the methods by which the data were collected. The information was collected from many sites across Florida and it is unknown if all health professionals entering the information were properly trained in the data collection process. This limited the ability to effectively measure or mediate the potential for reporting bias. The secondary data were secured data; there were no identifiers linking to the infected individual. Thus, it was impossible

to return to question the individual or medical professional for further clarification of information, if deemed relevant for this study.

Significance

There is a significant gap in the literature on any identified at-risk groups for drug-resistant gonorrhea, on a per region basis, in the state of Florida. All gonorrhea infections in Florida are reported through STARS and limited data is made available to the public through CHARTS. Within CHARTS, gonorrhea infection data is limited to the number of gonorrhea infections that occur per county per year along with basic demographics. Florida's reporting structure does not group counties into regions and has no regional reporting. There is extremely limited data on gonococcal drug-resistant infections in Florida, and there is no predictive reporting. Drug-resistant reporting for Florida is provided by the Gonococcal Isolate Surveillance System (GISP), which is not part of Florida's monitoring program (CDC, 2016a). Also, GISP reported on only one Florida county, Miami-Dade, for which reporting ceased in 2013. In addition, GISP only requires sampling for drug resistance from select demographic groups and not all identified cases (CDC, 2016a). Florida has not published any work on attempts to identify at-risk groups for drug-resistant strains at either a state, regional, or county level. Florida has currently failed to obtain a position or pursue further major research in this area.

This particular bacterium has been rapidly evolving drug resistance. The first drug-resistant case was identified in March of 2018 (Welch, 2018). The infected heterosexual male did not fit into the current high-risk group categories of WHO or the

CDC. This means that the generalized identified at-risk groups, such as homosexual males, sex workers, and pregnant women, may be too narrow ranging. For the state of Florida, each region needed to be evaluated for gonorrhea patterns that could lead to drug resistance. This then set a foundation for prevention initiatives that could be customized for each region. If effective interventions are implemented, there will be less of a need for treating gonorrhea with medications and thus, slow down or even stop the increasing foothold of drug-resistant strains.

Summary

Gonorrhea has been recorded since 130 A.D. and has most likely been in existence for a much longer time. Not only is it one of the oldest recorded sexually transmitted diseases, but it may also be even be one of, if not, the first. There is no legitimate information beyond herbal remedy speculations on how gonorrhea was treated prior to modern medicine. It was not until the first antibiotic was discovered in 1928 by Alexander Fleming and came to market in 1942 with the onset of World War II that an actual effective treatment for gonorrhea became available. Gonorrhea was first treated with antibiotics in 1943. In just over 70 years, society has gone from being able to simply and effectively treat gonorrhea to uncurable strains. This supports the concept that gonorrhea is an extremely resilient and highly adaptable pathogen. As a society we cannot continue to assume that science will be able to continuously find effective treatments for gonorrhea. The ability to cure gonorrhea is additionally compounded by the fact that it has asymptomatic behaviors that effectively camouflages it from detection by the host.

Public health professionals need to investigate non-drug treatment methods to stop the spread of this infection. Like any pathogen, if one can interrupt the lifecycle by not providing future hosts, then eradication and extinction is possible. Instead of continuously creating more medications that eventually become ineffective, interventions and safe sex practices would be of greater benefit. This study identified at-risk groups for drug-resistant strains of gonorrhea at regional levels and at the statewide level for future focused interventions. Many factors such as ethnic, age, culture, and the like can affect sexual behaviors. These can vary from state to state and region to region within the states. This study identified regional-based trends within Florida so that future effective interventions beyond drug treatments can be developed and more clearly focused on the regional populations.

Chapter 2: Literature Review

Introduction

The purpose of this quantitative study was to identify the groups that are most likely to contract drug-resistant gonorrhea in a given Florida region. Florida follows the guidelines recommended by the CDC for intervention strategies. Florida is diverse and has regional demographic variations. The recommended target groups do not uniformly match the demographics of each region. Drug resistance is driven by misuse or overuse of antimicrobial agents. This study compares the-last-line-of-defense treatments to the different demographic and risk factor characteristics in order to develop a predictive model for those who most likely will be at risk to contract drug-resistant variants of gonorrhea in each region and the state.

The pathogenic sexually transmitted bacterium *Neisseria gonorrhoeae* has been well documented for centuries and was first described by the Greeks in 130 A.D. (Black & Black, 2016). The term gonorrhea in Greek means "flow of seed" indicating that the common form of transmission was sexual (Black & Black, 2016). In the United States alone, there are over 800,000 identified cases per year (CDC, 2017). There are many more cases that are not recognized due to the asymptomatic behavior of the bacteria; the overall numbers may be much higher than what is being reported (Maraynes et al., 2017).

Over the last 50 years there have been a variety of ever-changing medications to treat gonorrhea (CDC, 2017). Due to the organism's ability to adapt, all but one of those antibiotic treatment plans are now useless (Alirol et al., 2017; CDC 2017; Kirkcaldy, 2016). The CDC stated in 2017 that cefixime and ceftriaxone together or in combination

with azithromycin is last drug treatment option. The CDC stated that this will not last, which makes drug-resistant gonorrhea an immediate and urgent public health issue (CDC, 2017).

Literature Review Methodology

The literature for this review was collected through various media. The initial review began with the CDC website on gonorrhea. The CDC is the leading authority in the United States for all reportable infectious diseases in the United States (U.S.) and its territories. Information on gonorrhea and gonococcal infections outside of the U.S. was also taken into consideration. The CDC site was reviewed extensively to gain a better understand of the core nature of gonorrhea and its drug-resistant behavior. The CDC site provided access to other published works. This "chain referencing" was a beneficial tool in identifying relevant works.

The second area of review evaluated the WHO's website for additional information and trends. Although this work focused on Florida, since gonorrhea is becoming a global crisis, it was considered a significant source to investigate. It is also important to understand that global transportation is relatively quick and affordable. Diseases can be transported in a matter of only a few hours through mechanisms such as air travel and longer for travel by sea. Florida, especially Disney World, is a common vacation destination for visitors from all over the world (Fyall, 2019). Thus, asymptomatic gonococcal infections can be easily transported into Florida. The other aspect is the sex trade, which is legal in other countries such as Germany and Canada (Weitzer, 2017). The chances of gonorrhea being brought back to the United States

through American sex tourists is significant (Weitzer, 2017). This also means there is a potential for introduction of new strains into the United States. The third area of review was the Florida Department of Health (FDOH) website on gonorrhea. This study focuses on gonococcal infections in Florida, thus the FDOH was an excellent site of information as well as another source of "chain referencing."

Upon complete review of the aforementioned websites, the literature search commenced. There were two different approaches to identify applicable literature. The first approach was to use Google Scholar. Google Scholar is not a complete database of information and it often presented irrelevant literature, but it is a useful tool that aided in "chain referencing." The second source of literature was to search through Walden University's database subscriptions such as Walden University's database PubMed, ProQuest, and Science Direct. These were cross-discipline databases in medicine, public health, and science providing a comprehensive search.

The literature review for the majority of this study was intentionally limited to literary works published in the last 5-years from the start of this dissertation and pertaining directly to the dissertation topic. The key terms used were *gonorrhea*, *gonorrhea infections*, *drug resistance*, *drug-resistant gonorrhea*, *Florida* and *history of Florida*. The phrase *drug-resistant gonorrhea* revealed the most direct and compelling research; *gonorrhea, drug resistant,* and *gonorrhea infections* were too broad. The acquisition of general gonorrhea knowledge used the term phrase *history of gonorrhea*. This provided literary works discussing the core epidemiology and etiology of gonorrhea. These literary works established foundational information for this dissertation. Literary

works that did not discuss drug-resistant gonorrhea or the history of gonorrhea were reviewed for pertinent information, but often were excluded.

Theoretical Framework

The purpose of theories in health is to provide a comprehensive understanding of factors that need to be considered for the designing, implementation, and evaluation of a health promotion program (Rimer & Glanz, 2015). Human behavior is complicated, and a theoretical understanding can be beneficial to the health professional. A health professional who has a working and grounded understanding in human behavior allows that professional to better support a person, family, group, or large community to improve their health status (Rimer & Glanz, 2015). The theories in health are designed as a guide in the understanding of why and how people and communities make health related choices (Rimer & Glanz, 2015). The theories in health offer an organized mechanism of grasping situations, appraising relationships, and forecasting outcomes (Rimer & Glanz, 2015). Theories in health will also explain the need for interventions, the best prescribed course of an intervention, and how to assess the successes or failures of an intervention (Rimer & Glanz, 2015). In the works of Rimer and Glanz (2015) they stated that theories help practitioners to interpret the findings of the research and make the jump from facts written on a piece of paper to comprehending the dynamic interactions between the environmental context and human behavior. Where theories provide a broad roadmap that aid in the explanation of the dynamics of human health behavior, identifying effective interventions, selecting suitable target audiences, and evaluating; outcome models narrow

down the approach and provide specific targeted structure for the health professional (Rimer & Glanz, 2015).

Health Belief Model (1966)

The foundation of the HBM of 1966 still holds true today. A review of literary works indicated that there is a considerable lack of knowledge within the public in regard to the transmission of gonorrhea, transmission of drug-resistant gonorrhea, and the reality of that everyone is susceptible to this infection. Current interventions are only targeting men who have sex with men, individuals in the sex trade industry, and pregnant women. In the eyes of the general public, the majority of individuals do not fall into these categories. This perpetuates the notation that most individuals are unlikely to contract gonococcal infections. In contrast to individual beliefs, a number of literary works indicate that there is a growing number of groups exclusive of the aforementioned three that are being infected by this bacterium. From a health theory standpoint this problem fits ideally with the 1966 HBM.

The 1966 HBM is based on four constructs (Hayden, 2017; McWhirter & Hoffman-Goetz, 2016). The first construct is perceived susceptibility (Hayden, 2017; McWhirter & Hoffman-Goetz, 2016). Perception is an influential mechanism directing individual behaviors. As mentioned, it is plausible that many individuals may think that since they do not fall within one of the three aforementioned identified categories, they are not susceptible to gonococcal infections. Unfortunately, this is a blind interpretation. Although they as an individual may not fall into one of these categories, their partner

could have been and still be, an unknowing asymptomatic carrier. Open relationships and relationships where one or more partners are unfaithful can also be problematic.

The second construct is perceived severity (Hayden, 2017; McWhirter & Hoffman-Goetz, 2016). Humans in this world have become reliant on the notion that medicine can cure all. This creates the false sense of health safety for individuals. It perpetuates the belief that even if they do acquire a gonococcal infection it will be easily cured through medical invention. This generates an appearance that a gonococcal infection is no more than a minor inconvenience. Perceptions as these, are extremely disconcerting and can perpetuate the spread infections.

The third construct is perceived barriers (Hayden, 2017; McWhirter & Hoffman-Goetz, 2016). Barriers, in relationship to gonococcal infections, are that gonorrhea is becoming drug resistant. There is a significant lack of information to the public educating them that gonococcal infections are not only on the verge of being completely drug resistant, but there has now been at least one documented case. The lack of information to the public, may cloak the perception that there are barriers of incurable gonococcal infections. The greatest unseen current barrier is the actual lack of public knowledge regarding this bacterium.

The final construct is the perceived cost of adhering to the propose intervention (Hayden, 2017; McWhirter & Hoffman-Goetz, 2016). There is a perception that most antibiotics are relatively inexpensive. This can lead to a false interpretation that it is relatively inexpensive to treat a gonococcal infection. The medications currently being used cost insurance and government-based insurance approximately $162 million per

year or $202 per person per year (Chesson et al., 2014). Overall, this is not too great of a financial burden on an individual. Leading them to be unconcerned if they contract a gonococcal infection.

Theory of Reasoned Action (1975)

The (TRA) the is based on the assumption that an individual considers the consequences of their behavior before engaging in that particular behavior (Ajzen, 1985). Within this model there are three constructs. The first is behavioral attitude (Ajzen, 1985). This construct states that the behavior intention is a function of that individual's attitude about the behavior and subjective norms (Ajzen, 1985). The second is attitude and it can be understood as the decision of one's behavior based on how others would perceive that individual if the behavior is or is not conducted (Ajzen, 1985). The third is the subjective norm and is based on the perceived expectations by key individuals in that individual's life.

TRA can be influential in the decision-making process of and for sexual activity associated with the risk of contracting a gonococcal infection. The WHO and the CDC have currently identified the at-risk groups for contracting gonorrhea as pregnant women, sex workers, and men who have sex with men (CDC, 2018). Under the TRA model an individual who does not fall within any one of these categories would not consider themselves at risk. The perception would then be that they would not need to worry how others perceive them since they would not be subject to contracting the pathogen. From a TRA standpoint there would be no judgement and they would most likely proceed forward with the risk behavior. If the at-risk groups can be narrowed down to a regional

level, this may then change the perception of who is at-risk. This in turn changes how an individual evaluates the outcome of their action in conjunction of how others perceive them based on their actions.

Basics about Gonorrhea

History

Neisseria gonorrhoeae, or gonorrhea, is considered one of the earliest known human pathogenic bacteria (Morgan & Decker, 2016). It is not known how long gonorrhea has been plaguing humankind. It is safe to state, that it has been known for at least 2000 years. The historical roots of this bacterium are vastly deep and impactful on human health, so much so that it has even been documented within the biblical scriptures (Morgan & Decker, 2016). Circa 130-200AD, the Greek physician Galan was the first to name and describe gonorrhea. The term is based in the ancient Greek language and translates as an "unwanted excretion of seamen" (Morgan & Decker, 2016). Other scholars have translated it literally from Latin as "flow of seed" (Black & Black, 2016). Regardless of which translation is used, both the ancient Greek and Latin languages indicate that *N. gonorrhoeae* has an association with sexual transmission.

Gonorrhea has a secondary name that is believed to have arisen from geographical origins. It for centuries has been referred to as "the clap" (Black & Black, 2016). Circa 1378 there was an area of Paris known for prostitution as Les Clapiers (Black & Black, 2016). It is believed this geographical location supported the spread of gonorrhea and originated the street term the "clap." For centuries gonorrhea was only identified by its symptoms. It was not until the invention of the microscope that Albert Ludwig

Sigesmund Neisser in 1916 was able to successfully taxonomically describe gonorrhea as gram-negative diplococci (Black & Black, 2016). It was from a combination of Neisser's work and the symptomatic description from ancient Greece, that gonorrhea has earned its modern taxonomic binomial name *Neisseria gonorrhoeae.*

Etiology

Gonorrhea is a gram-negative diplococcus bacterium. It has an affinity for, and infects the mucosal surfaces of the genital tract (Sherrard, 2014). Gonorrhea will infect the urethra as well as the genital glands, uterine cervix, fallopian tubes, epididymites, anal canal, distal rectum, oropharynx, and eyes (Sherrard, 2014). Under specific conditions or anatomical position, a female with an active vaginal gonorrhea infection can then become anally infected (Morgan & Decker, 2016). This cross contamination is due in part to the close proximity of the vagina and anus, and that gonorrhea can cause fluid discharge from the vaginal cavity (Morgan & Decker, 2016). Although gonorrhea can be a discomforting and an irritating infection, it also has the ability to be extremely dangerous. There are a multitude of associated risks. It has been documented that an individual infected with gonorrhea may eventually acquire pelvic inflammatory disease, sterility, septicemia, and necrosis as well as having a greater chance of contracting HIV infections (CDC, 2017).

There is also a 30% risk of vertical transmission from infected mothers to babies during the birthing process (Sherrard, 2014). Within a few weeks of birth, babies will exhibit ophthalmia neonatorum and if left untreated, will cause blindness (Sherrard, 2014). There are instances of neonatal sepsis infection occurring specifically in cases

when there has been prolonged rupture of membranes or preterm delivery (Sherrard, 2014). Neonatal sepsis can lead to infant death. If an infant (non-newborn) or a child contracts gonorrhea, experts advise that it may be related to sexual abuse and will require authoritative and legal intervention (Sherrard, 2014).

Antimicrobial History

The sulfonamides were considered the first antimicrobial agents affective against gonorrhea and were discovered by Gerhard Domagk in 1935 (Unemo & Shafer, 2014). The sulfonamides had an 80% to 90% success rate (Unemo & Shafer, 2014). By 1944 the sulfonamides were no longer effective. Luckily in 1928 Alexander Fleming discovered penicillin (Black & Black, 2016). Due to production costs, it was not affordably produced until 1942. In 1943 the medical community was able to begin using it on gonorrhea. The effectiveness did not last long. Only three years later in 1946 gonorrhea became resistant to penicillin (Unemo & Shafer, 2014). Tetracycline discovered by Benjamin Dugger was the next antimicrobial used to treat gonorrhea infections. By 1986 gonorrhea was resistant to that antimicrobial. Within the same time-period, around 1967 spectinomycin was also rendered useless (Unemo & Shafer, 2014). As time passed, each antimicrobial for gonorrhea became obsolete. Macrolide (azithromycin) in 1999, Cephalosporins in 2003, and Quinolones in 2007 (Black & Black, 2016).

Treatment

The treatment of gonorrhea has been complicated due to its ability to develop antibiotic resistance quite quickly (Morgan & Decker, 2016). There is a growing concern in the medical community over this issue. Gonorrhea is now resistant to multiple classes

of antimicrobial drugs including sulfonamides, penicillins, tetracyclines, macrolides, fluoroquinolones, and just recently cephalosporins (Morgan & Decker, 2016). Only in the last few years gonococcal antibiotic resistance has become a worldwide problem (Morgan & Decker, 2016; Sherrad, 2014). Pharmaceutical companies are scrambling for new chemical controls. A review (2018) of the Federal Drug Administration Clinical Trials website indicated that there are at minimum 60 clinical trials being conducted to find antibiotic treatments for gonorrhea. Over the last 50 years there have been a variety of medications to treat gonorrhea (CDC, 2017). The constant changing of drug treatment protocols are a direct result of the resilience of gonorrhea (CDC, 2017). The treatment medicines and modes of treatments are changing every few years (CDC, 2017).

Gonorrhea as a survival tactic, has evolved to become drug resistant over and over. Every time a new antibiotic is introduced, the bacterium becomes resistant in as little as one decade to that drug or treatment plan (CDC, 2017). Gonorrhea has been so successful that all but one of the many drug treatment plans are now useless (Alirol et al., 2017; CDC, 2017; Kirkcaldy, 2016). Cefixime and ceftriaxone in combination or in combination with azithromycin is considered the last treatment left to combat gonorrhea (Morgan & Decker, 2016). These antibiotics are used in series as a combined treatment because they are not effective enough to be used as standalones (Kirkcaldy, 2016) Unfortunately, gonorrhea is showing signs of resistance to these treatments (Morgan & Decker, 2016). In March 2018, the first case of complete drug-resistant gonorrhea or "super gonorrhea" was documented (Ducharme, 2018). Additionally, although not completely drug resistant as in the March 2018 case, in January 2019 two unrelated

British women contracted variants that are resistant to the current prescribe recommended treatments (Gallagher, 2019).

Current Issues

Neisseria gonorrhoeae ranks second as the most common notifiable sexually transmitted disease in the United States (Morgan & Decker, 2016). In the United States alone, there are over 800,000 identified cases of any strain of gonorrhea per year (CDC, 2017). The estimated medical cost is $162 million per year (Chesson et al., 2014). Worldwide there are approximately 62 million cases diagnosed (Sherrad, 2014). Researchers believe that this is too low of an estimate, that the current numbers are grossly inaccurate, and the actual rates are significantly higher (Maraynes et al., 2017).

The belief that the information is inaccurate is based in part within the unique behavior of the bacterium. In adults, gonorrhea is almost always transmitted sexually (Sherrard, 2014). The classical presentation of a gonococcal infection for a male is white to yellow discharge from the urethra (Kerani et al., 2015). In more advanced cases, green discharge from the urethra (Kerani et al., 2015). The male individual will at times have painful and burning sensations in the urethra and glans during urination (Kerani et al., 2015). Females also exhibit white to yellow and in some cases green discharge, but it will come from the cervix and not the urethra (Kerani et al., 2015). The female infected with gonorrhea will also have abdominal pain and in some cases leading toward Pelvic Inflammatory Disease (PID) (Kerani et al., 2015). Gonorrhea has a dark side where it can also exhibit asymptomatic behavior in 40% of the infected males and 60%-80% of the infected females (CDC, 2017). The literature indicates that up to 60% of all individuals

infected with gonorrhea are unaware of their infection (CDC, 2017). Gonorrhea transmission is more efficient from male to female due to anatomical characteristics (Sherrard, 2014). The risk of acquiring gonorrhea from an infected partner, only having a single unprotected sexual intercourse act, is estimated at 30% to 70% regardless of anatomical sex (Morgan & Decker, 2016; Sherrard, 2014). The physiological design of females versus males coupled with the bacterium's behavior, is why females will be more asymptomatic than males (Kerani et al., 2015). Gonorrhea's asymptomatic behavior makes it very difficult to diagnose (CDC, 2017). Characteristically if an individual is not presenting signs or symptoms, they will not seek out medical intervention (CDC, 2017). They will instead become a biological vector for this bacterium (CDC, 2017). Based on these percentages alone, it could be elucidated that the true number of infected individuals globally are in the hundreds of millions.

There may be some hope on the horizon. There are times during the drug-resistant evolution of a bacterium they lose resistance to earlier historical treatments. There have been some studies indicating that azithromycin is having an increased effectiveness against gonorrhea (Martin et al., 2016). Although this may be a positive indication, gonorrhea, at one time became fully resistant to azithromycin. This then leaves the possibility of gonorrhea becoming resistant again and in a much shorter time period than before.

The issue of drug-resistant gonorrhea could be overcome by simple interventions. Regrettably, currently there is little discussion outside of the medical community regarding gonococcal drug resistance. An uninformed public will fuel this growing issue.

Adding to the lack of information, or more so of isolating the general public's mind set, the targeted groups as recommended by the CDC and the WHO for gonococcal infection interventions are men who have sex with men, individuals who work in the sex trade such as escorts, exotic dancers, and prostitutes, and pregnant women (CDC, 2017). This creates an ideological thought with the common public, perpetuating the behavior because the mindset is; that if a person does not fall into one of these categories, they are not at risk for contracting this infection. Unfortunately, this is may not be the case and the current recommendations for targeted intervention may in fact be exasperating the spread of the infection through basic unawareness and misinforming of the general public.

Recent Research on Drug-Resistant Gonorrhea

There are currently different methods being implemented to combat drug-resistant gonorrhea. The works that approach from a surveillance and intervention standpoint are Barbee (2014), Chesson, Kirkcaldy, Gift, Owusu-Edusel Jr., and Weinstock (2014); Fingerhuth, Bonhoffer, Low, and Althaus (2016); Golparian, and Shafer (2014); Kirkcaldy et al. (2016); Mackenzie and Decker (2016); Martin et al. (2016); Sherrard (2014); Town et al. (2015); Unemo and Shafer (2014); Unemo (2014); Wi et al. (2017); and Ventola (2015). The works that are confronting this issue from the molecular and cellular viewpoint in order to gain a better understanding of the genomic complexities of why the bacterium is drug resistant and how it becomes drug resistant are Alm et al. (2014); Allan-Blitz et al. (2017); Allan-Blitz et al. (2018); Basarab et al. (2015); Baym, Stone, and Kishony (2016); Buono et al. (2014); Jacobsson et al. (2014); Unemo, del Rio, and Shafer (2016); Unemo (2015); and Goparian, Shafer, Ohnishi, and the Unemo (2015)

The surveillance researchers are studying gonococcal infection rates. The work of Ventola (2015) identifies nationwide gonococcal infections basing those infections on the number of prescriptions written on a state-by-state basis. They are also studying over prescribing of antibiotics for both individual and commercial purposes with the expectations of detecting potential zones of drug resistance. Unemo and Shafer (2014) take a different approach. Their surveillance program collects information based on positive laboratory identification of drug-resistant strains of gonorrhea. The Gonococcal Isolate Surveillance Project (GISP) is utilized by Chesson et al. (2014), Fingerhuth et al. (2016) and Kirkcaldy et al. (2016). They collect their information through GISP which in turn gathers its data from participating clinics and laboratories. The information provided directly to GISP has been vetted through the CDC for accuracy in reporting. Kirkcaldy et al. (2016) compile this data and track the evolution of drug-resistant strains. Kirkcaldy et al. (2016) have stated that currently, GISP is the only source of national and regional gonococcal antimicrobial susceptibility data in the United States. Unemo (2015) and Unemo and Shafer (2014), are using data collected from other literary works to develop a complete comprehensive overview of the extent of gonorrhea drug resistance.

The understanding of where these infections are happening, how extensive the prevalence rates are, and the number of drug-resistant strains is invaluable. It is unlikely that a gonococcal infection can be stopped without some form of medical or public health intervention. Unless the mechanisms of how drug resistance and susceptibility are understood there may be no future medicinal options. Jacobsson et al. (2014); Allan-Blitz et al. (2017); Allan-Blitz et al. (2018); Basarab et al. (2015); Buono et al. (2014); and

Unemo et al. (2016) are investigating the mechanism in which the gonococcal bacterium uptakes or blocks antimicrobial medicines. The main research focus targets the mechanism(s) in which the antimicrobial drugs pass through the cellular membrane. These researchers are also investigating what happens when the medications enter the cellular matrices. Jacobsson et al. (2014) has elucidated that there is a significant genetic link to antimicrobial resistance. The team investigated the DNA Gyrase Inhibitor AZD0914 and manipulated it to have the ability to activate or deactivate it. The motive was to determine if this genome has a role in gonococcal drug resistance. Similarly, Alm et al. (2015) studied the same genome but used a different approach. Instead of controlling the genome which could add bias to the study. They used strains of gonorrhea which already have both active and inactive AZD0914 genomes. This was then used as a comparison for antimicrobial effectiveness.

Genetics

From the studies it is been found that *N. gonorrhoeae* has an extraordinary capacity to alter its genetic material (Golparian & Shafer 2014). Other species within the *Neisseria* genera share this ability (Golparian & Shafer 2014). Gonorrhea has the ability to transfer partial or whole genes during its entire life cycle. This means it can effectively change its genome through all types of mutations. It incorporates these mechanisms to quickly adapt and survive to changing environmental factors. This rapid evolutionary ability has allowed gonorrhea to survive in the most hostile environments of the human body such as the mucosa of the urinary tract or the vaginal cavity (Golparian & Shafer 2014). Its abilities to rapidly mutate through genomic exchange indicates it has either

mutated, acquired, or developed all of its known physiological mechanisms for antimicrobial resistance. The findings in the literary works elucidate that gonorrhea's antimicrobial resistance is imbedded in its chromosomes. It has been directly identified as chromosomes bla_{TEM} gene and the *tet*M gene (Unemo & Shafer, 2014). It is these genes that have resulted in a high level of resistance for penicillin and tetracycline. Within the bacterial cell this drug-resistant genetic material is found in the plasmid. There is significance in where this critical information is housed in the cell. It is being and has been well documented and known that bacteria as well as all cells participate in molecular level cellular communication (Black & Black, 2016). It is not been known until recently what the is the significance of this ability. In the works of Unemo and Shafer (2014) they have reported that gonococcal antibiotic resistance can be passed through gene transfer. Bacteria conduct genomic transfer by interlocking to each other's plasmids. Thus, the storage of critical genomic information within the plasmid means a more rapid transfer of the genomic code. The other significance of this molecular level communication is that if there is at minimum of one bacterium within the genus *Neisseria* caring antibiotic resistant genetic mutations, that bacterium can then pass that specific genetic code onto another *Neisseria sp.* including the gonorrhea bacterium. There is two-fold significant concern with this behavior. First, if someone is carrying any drug-resistant *Neisseria sp.,* even those that are commensal; if that individual is exposed to a drug susceptible gonorrhea strain, once that drug susceptible strain exchanges genomic information in situ it becomes instantaneously drug resistant. The other concern, to put it simply, if you have just one bacterium per antimicrobial drug that carries resistance, each

of those bacteria can then transfer those antimicrobial drug genetic codes to a common colony; developing a strain of "super bugs" that are resistant to all antimicrobial drugs.

There is thought that gonorrhea may soon be classified as a genetic a reservoir of the antimicrobial resistant genes (Golparian & Shafer 2014; Unemo & Shafer, 2014). It has been found that there is an entire group of commensal bacteria in the *Neisseria* genera that frequently inhabit human anatomical sites including but not limited to the pharynx (*Neisseria spp*.) (Unemo, 2015). These areas are often exposed to antimicrobial medication for the treatment of other infections. Because *Neisseria* has such an affinity for survival, these commensal bacteria may also be creating drug-resistant variants to antimicrobial medications that have not yet been tested or evaluated for curing gonococcal infections (Unemo, 2015). Studies also indicate *Neisseria spp*. through transformation (transfer of genetic material from one bacterium to another) pass these drug-resistant genes to other species in their same genera (Black & Black, 2016). It is believed that this horizontal gene transfer is what may have plausibly played a pivotal role in the transfer of and spread of the mosaic *penA* allele creating cephalosporin resistance (Baym, Stone, & Kishony, 2016). The transfer and uptake of DNA between species within the same genera is quite rapid (Golparian & Shafer 2014). These antimicrobial resistant gonococcal strains spread rapidly and quickly within their geographical region and eventually establish an international presence (Unemo & Shafer, 2014). There has been cause for concern but has yet to be proven that gonococcal strains could share antimicrobial resistant genes with other non-like genera and species

(Golparian & Shafer 2014). Currently there is no proven cause for concern, but it may become problematic in the future.

Antimicrobial Defense

Antimicrobials medications attack bacteria by binding to specific targets that are critical for the vitality and function of the bacterium (Unemo & Shafer, 2014). Through this molecular binding the bacterium's functions are interrupted, and death occurs (Unemo & Shafer, 2014). The bacterium overcomes this issue is by altering its binding sites through genomic mutation (Unemo & Shafer, 2014). This renders the antimicrobial chemical ineffective. Cleverly the changing of the antimicrobial binding side is only enough to stop the antimicrobial chemical but not enough to interfere with the ongoing functions of the bacterium cell. This does not affect or lower the overall physiological fitness of the bacterium (Unemo & Shafer, 2014). It has also been found that in some variants of *N. gonorrhoeae,* it instead enhanced the biological fitness of the bacterium (Unemo & Shafer, 2014). Interpretively, not only have antimicrobial medications been rendered ineffective, but they have also strengthened the bacteria.

Fitness

There is evidence in the research that in the absence of antimicrobial medications, gonorrhoeae may become less fit. This indicates that the resilience and fitness of gonorrhea coincides with environmental pressures (Golparian & Shafer 2014). The greater the environmental pressure, the greater its fitness. Gonorrhea has also derived mechanisms of self-preservation regardless of the presence of antimicrobial chemicals. During the infection, the human body is bombarding the bacteria with antibodies and

other antimicrobial attacks (Black & Black, 2016). The bacterium will mutate to strengthen and protect itself from the immune system (Unemo, del Rio & Shafer, 2016). As part of its defensive strategy, gonorrhea will incorporate host-derived compounds to protect itself from antimicrobial attacks (Unemo et al., 2016). One of the best examples of this, is gonorrhea using polyamines that are found in the male genitalia tract as a coating for itself (Unemo et al., 2016). Thus, the bacteria will camouflage itself from the host's immune system (Unemo et al., 2016). The coating also inhibits complement-mediated killing from the hosts immune system (Unemo et al., 2016). Gonococci have been documented in laboratory conditions creating biofilms that help make it resistant to antimicrobials (Unemo et al., 2016). This only emphasizes that gonorrhea is an extremely resilient, highly fit, bacteria and why it has survived thousands of years.

History and Geography of Florida

Florida Historical Origins

Florida was once Spanish owned. Juan Ponce de Leon was the first to lead a European expedition to Florida in 1513 (Arnade, 1961; Greenberger, 2005; Worth, 2014). It is believed and has been historically documented, that he made landfall just south of Cape Canaveral Florida (Worth, 2014). He originally named the state "Pascua Florida" or feast of flowers as a tribute to Spain's Easter celebration (Worth, 2014). Over time, Spanish influenced increased with other explores such as Lucas Vázquez de Ayllón in 1526, Pánfilo de Narváez, in 1527, Hernado De Soto in 1539, and Tristán de Luna y Arellano in 1559 all bringing European diseases and decimating upwards of 90% of the native population (Moore, 2013).

In 1565 the Spanish created the first permanent European settlement in North America in Saint Augustine Florida (Moore, 2013; Worth, 2014). To this day Saint Augustine is a thriving successful city. In 1562 the French attempted to explore and settle parts of Florida under Jean Ribault, bringing French culture into the mix (Broussard, 2003). By 1581 African slaves were being introduced into Florida through the city of St. Augustine (Johnson, 2002). In 1586 the British began to see value in Florida and Sir Francis Drake attacked and burned down Saint Augustine in an attempt to establish an English settlement (Keeler, 2017). The Spanish continued for the next hundred years to colonize Florida as a Spanish territory and spreading religion by establishing over 100 missions throughout the northern region of Florida up and into Georgia (Moore, 2013; Worth, 2014). In 1702 the British again made a move to out the Spanish from Florida by destroying all the Spanish missions (Childers, 2004). Again in 1740 the English General James Oglethorpe invades Saint Augustine (Childers, 2004). By 1763 England is now the ruling faction over Florida (Halbirt, 2004). But this role did not last long and the Spanish in 1783 took back Florida (Childers, 2004). During this time, the United States was establishing itself as a strength to be reckoned with.

At one time Florida's panhandle stretched from the Savanna River to the Mississippi. Over time the boundaries were pushed back due to battles and skirmishes until it is reached its present boundaries (Cusick, 2007). Finally, in 1819 the Spanish realized they could no longer hold Florida and relinquished it to the United States by leaving the state (Cusick, 2007). Thus, handing control over to the United States. Once the United States gained control of Florida, many southern Americans began to migrate

into its northern sections. It was sometime before the southern part of Florida became populated. Florida was approved on March 3, 1845 to enter the union. It was officially designated as the 27th state (Weitz & Sheppard, 2018). Not long after statehood, Florida in 1851, established two colleges which to this date are still some of the most recognized institutions in the country. They are the now Florida state University (formerly West Florida Seminary) and the University of Florida (formally East Florida Seminary) (Weitz & Sheppard, 2018). Although Florida was the only southern state who avoided its capital, Tallahassee, from being captured by the Union, the suicidal death of Governor John Milton force Florida to become Federally controlled and no longer a Confederate state in 1865 (Weitz & Sheppard, 2018).

Florida Demographical History

From a demographic standpoint one can say that the northern part of Florida has a southern personality whereas the southern part of Florida has a northern personality. Florida could be considered a patchwork of cultures. The early Spanish around 1500 to 1600 settled primarily in the panhandle and along the northern coast (Arnade, 1961; Greenberger, 2005; Worth, 2014). The central part of Florida around 1800 was settled by a collage of individuals such as native Americans, farmers, escaped slaves, and ranchers who to this day are commonly referred to as crackers (Otto, 1987). The farming industry became an important cultural draw to the State. To meet the growing demands for farmland, in 1901 the Everglade drainage projects began (Light & Dineen, 1994). Besides dramatically changing the landscape negatively from an environmental standpoint, it dried a significant number of wetlands to the south (Light & Dineen, 1994).

This then created more inhabitable land for both the farmer and entrepreneur. This new organically rich and now inhabitable land was an attraction for more people to move to the southern parts of the State.

Starting in the mid-1900s until present Southern Florida has seen an influx of the modern pioneer. Americans from all over the country, different states, and different cultures have established themselves in many parts of the southern areas of Florida. The primary demographics of south Florida consisted of mixed Europeans moving down from the northern States. Then in 1980 there was a dramatic cultural shift to the southernmost part of Florida (Hause, 2016). In an effort to aid political refugees from communist Cuba, the Mariel boatlift occurred. This caused a major influx of Latin culture into the southernmost part of Florida (Alberts, 2016). It created a dramatic change in the demographics and behaviors. With the Cuban influx and primarily Spanish speaking population, the southern part of Florida, principally Miami-Dade, began attracting more Spanish speaking individuals from other nations (Alberts, 2016). It became an area where English speaking was not needed to thrive. This created a very unique demographic population in the Miami-Dade area with cultural beliefs that are very different than the rest of the state (Alberts, 2016). The movement to Florida in the 1900's was exponential. It is estimated that since 1950 the population of Florida has grown over 700% (U.S. Census, 2018).

Florida Geography

Florida is the Southernmost state in the continental United States. It is located along the eastern seaboard and is a peninsula (Cooke, 1945; Sellards, 1919). It is

surrounded by the Atlantic Ocean to the East and the Gulf of Mexico to the West. It is 58,560 square miles and it is 447 miles long by 361 miles wide (Cooke, 1945; Sellards, 1919). The highest natural point is only 345 feet above sea level. It hosts 1,197 statute miles of coastline, 663 miles of beaches, over 7,700 lakes, and over 4,500 islands (Cooke, 1945; Sellards, 1919). The largest lake in the state which is also the drinking water reserve for Central Florida, Lake Okeechobee is 700 square miles connected to the longest river in the State, the St. Johns River as 273 miles in length (Corrales, Naja, Bhat, & Miralles-Wilhelm, 2017).

There are three primary geographical land formations in the state which define in part how individuals settled within Florida attracted by areas to settle for farming, mining, and other commercial interests (Odum, 2018). The South Atlantic Coastal Plain (SACP) includes northeastern Florida's coast. It extends from Florida's northern border on the Atlantic seaboard, southward about 150 miles to the area around Cape Canaveral. It then turns and runs northwesterly and inland toward the New York-Alabama Lineament, the suspected slip-strike fault on the eastern edge of the Mississippi Valley. The SACP features barrier islands with both sand dunes and maritime forests of southern sugar maple and white ash. These areas are backed by salt marshes. The bays support forested wetlands, such as mangroves and mangrove swamps (Ramos-Fregonezi, et al, 2015).

The Atlantic Coastal Plain (ACP) is divided by the South Atlantic Coastal Plain. The ACP extends from the south shore of Long Island, New York, all the way to the southern tip of Florida in the Dry Tortugas which are a chain of five islands west of the

Florida Keys. The plain then runs northward along the state's Gulf coast to Apalachicola, where it is bounded by the East Gulf Coastal Plain. The ACP lacks the hilly upland areas that characterize the SACP, but it includes the beaches found on both coasts of the peninsula and the Everglades. The Everglades is also well known as the "river of grass" due to its high content of wetland grasses that eventually lead out to seagrasses in the saltier marshes. The Everglades constitutes much of the southern tip of the state (Rovere et al., 2015).

The East Gulf Coast Plain (EGCP) is another coastal plain with the same general geographic characteristics as the SACP and the ACP. Unlike the SACP and the ACP it includes much of the coastal areas of the Gulf of Mexico as far north as Panama City. The geology is very unique on side of the state and the EGCP. Most of the coastal side of the EGCP hosts white-sand beaches from as far south as Tampa Bay to the panhandle of Florida. This is due to erosion from the high calcium carbonates found sediments of the area (Sluijs et al., 2014).

Florida Statewide Demographics

There is no doubt that Florida has experienced historical immigration and emigration of many different ethnic and cultural groups over the centuries. From the earliest of settlers to the present, Florida continues to be an ever-expanding melting pot of genetic diversity. Florida hosts approximately 20.984 million residents (U.S. Census, 2018). The key demographics of the state breaks down and are estimated as the following: 54.9% of the population is White alone, 16.8% Black alone, and 24.9% Hispanic alone; 51.1% female gender with 54.3% of the total female population being

employed; 53.1% of the population is between the ages of 18 and 65; over 80% of the population is American born (U.S. Census, 2018); and the median income for the state is $48,900 per year, with 64.8% of the houses owner occupied (U.S. Census, 2018). Only 14.7% of the total population is living in poverty. The population per square mile is 350.6 persons. It is important to realize that these are estimates. The last census was conducted in 2010 and the ethnic demographics were the following: 57.9% White alone, 15.2% Black alone, 0.3% Native alone, 2.4% Asian alone, 0.1% native Hawaiian alone, 1.5% two races, 22.5% Latino or Hispanic, and 0.3% other race (U.S. Census, 2018). Based on that same census the total population at the time was 18,801,310 persons and is currently estimated at 20,984,400 (U.S. Census, 2018).

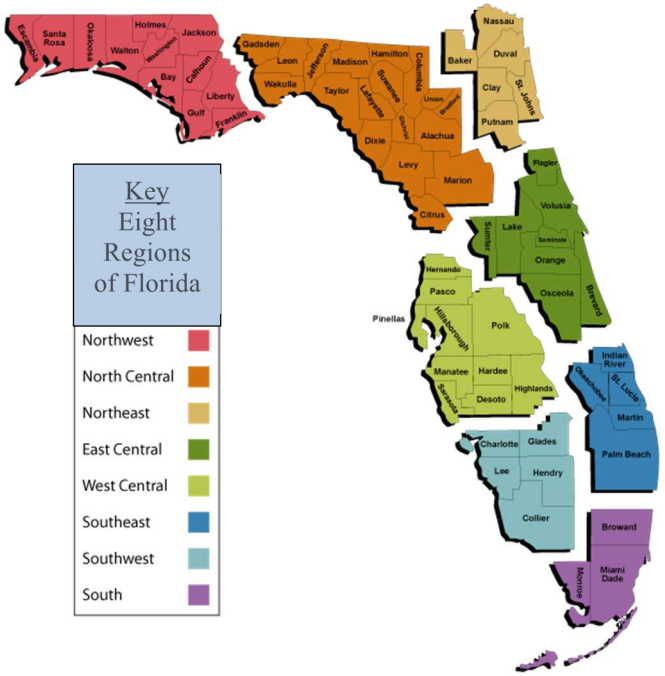
Florida Regional Demographics

Florida's demographics are not evenly distributed across the state for some of the ethnic groups. It is concentrated into the different regions primarily influenced by historical events and immigration and migration pattern. Florida itself is divided into 67 counties (U.S. Census, 2018). For this study Florida was divided into eight regions (Figure 1). The Northwest which includes Escambia, Santa Rosas, Okaloosa, Walton, Holmes, Washington, Jackson, Bay, Calhoun, Gulf, Liberty, and Franklin counites. The North Central hosts Gadsden, Leon, Wakulla, Jefferson, Madison, Taylor, Lafayette, Hamilton, Suwanee, Dixie, Columbia, Gilchrist, Union, Bradford, Alachua, Levy, Marion, and Citrus counties. The Northeast consists of Nassau, Baker, Duval, Clay, Putnam, and St. Johns county. The East Central includes Sumter, Lake, Flagler, Volusia, Seminole, Orange, Osceola, and Brevard counties. West Central has Hernando, Pasco,

Pinellas, Hillsborough, Polk, Manatee, Sarasota, Hardee, Desoto, and Highlands. The Southwest hosts Charlotte, Glades, Lee, Hendry, and Collier. The Southeast is home to Indian River, Okeechobee, Saint Lucie, Martin, and Palm Beach. The Southern hosted. Broward, Monroe, and Miami-Dade. When evaluating Florida at a region by region level it has vast differences in the demographic distribution in relationship to the state as a whole.

Figure 1

The Eight Regions of Florida

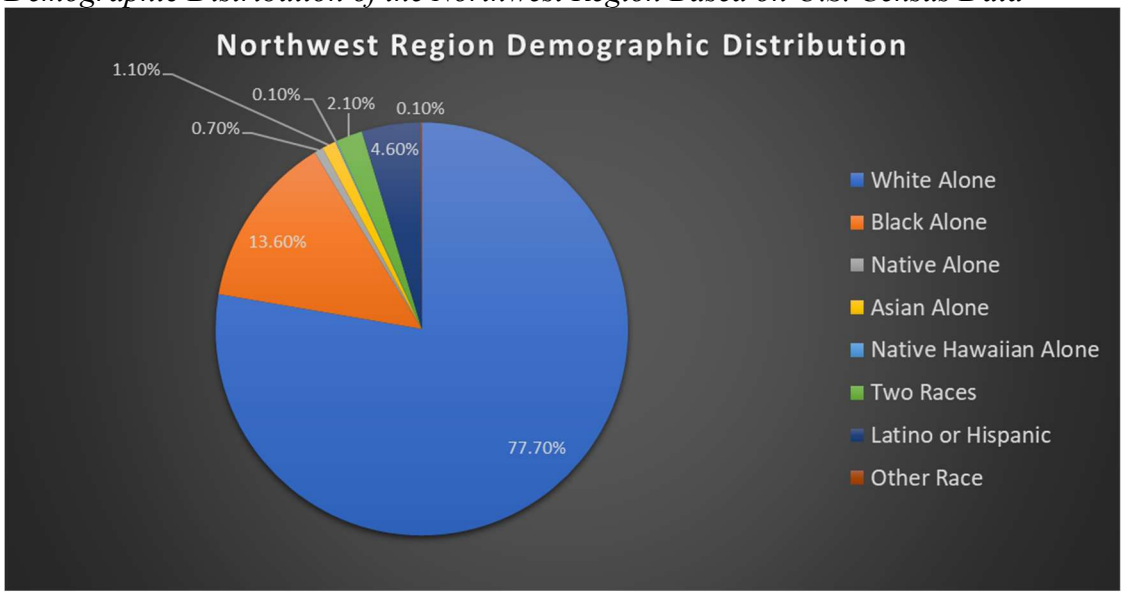


Note. Depicts the eight regions of Florida and counties within. Image adopted and modified from https://www.flcenterfornursing.org/RegionalData/FCNRegionalWorkforceReports.aspx. and the FDOH http://www.flhealthsource.gov/bgs-providers 2018. Florida Center for Nursing and the FDOH.

Using the known census data and not estimates, the Northwest region has the following demographics: 77.7% White alone, 13.6% Black alone, 0.7% Native alone, 1.1% Asian alone, 0.1% native Hawaiian alone, 2.1% two races, 4.6% Latino or Hispanic, and 0.1% other race (Figure 2). Total population was 1,039,053 persons and 5.5% of the total population of the state (U.S. Census, 2018).

Figure 2

Demographic Distribution of the Northwest Region Based on U.S. Census Data

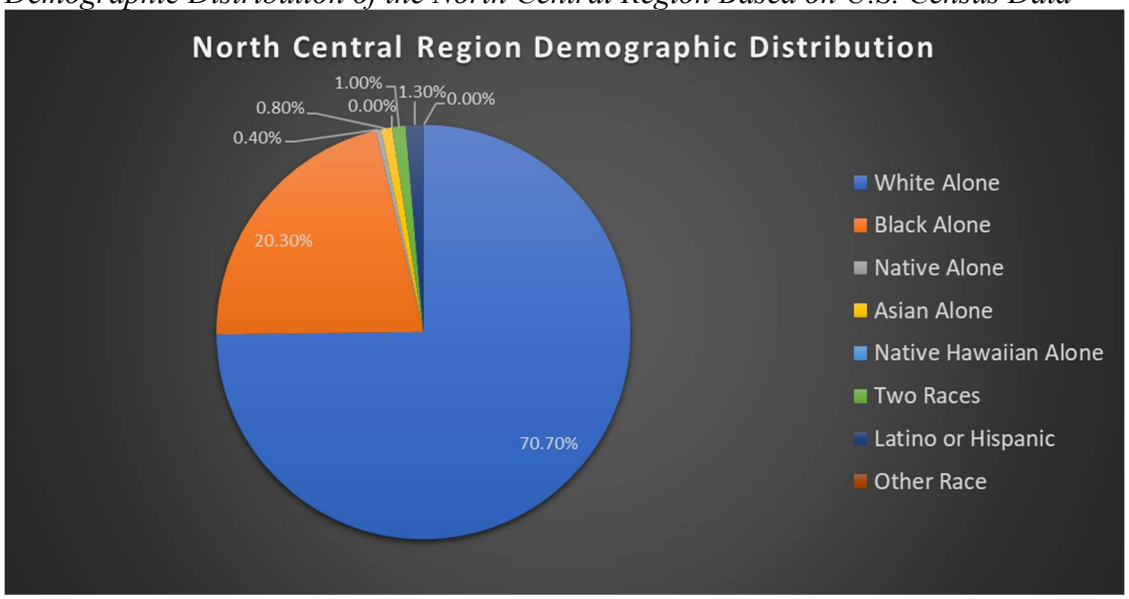


Note. Pie chart of the demographic distribution of the Northwest region of Florida. The data were provided by the U.S. Census Bureau (2018).

The North Central region has the following demographics: 70.7% White alone, 20.3% Black alone, 0.4% Native alone, 0.8% Asian alone, 0.0% native Hawaiian alone, 1.3% two races, 6.4% Latino or Hispanic, and 0.1% other race (Figure 3) (U.S. Census, 2018). Total population was 1,504,399 persons and 8% of the total population of the state (U. S. Census, 2018).

Figure 3

Demographic Distribution of the North Central Region Based on U.S. Census Data

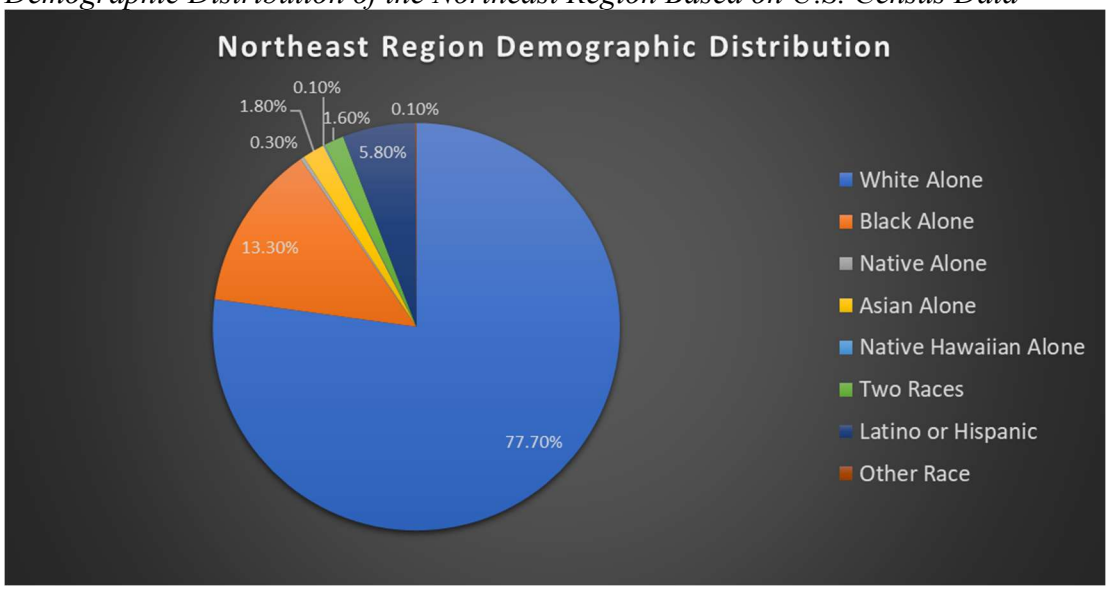


Note. Pie chart of the demographic distribution of the North Central region of Florida. The data were provided by the U.S. Census Bureau (2018).

The Northeast region has the following demographics: 77.7% White alone, 13.3% Black alone, 0.3% Native alone, 1.8% Asian alone, 0.1% native Hawaiian alone, 1.6% two races, 5.8% Latino or Hispanic, and 0.1% other race (Figure 4) (U. S. Census, 2018). Total population was 1,419,960 persons and 7.5% of the total population of the state (U.S. Census, 2018).

Figure 4

Demographic Distribution of the Northeast Region Based on U.S. Census Data

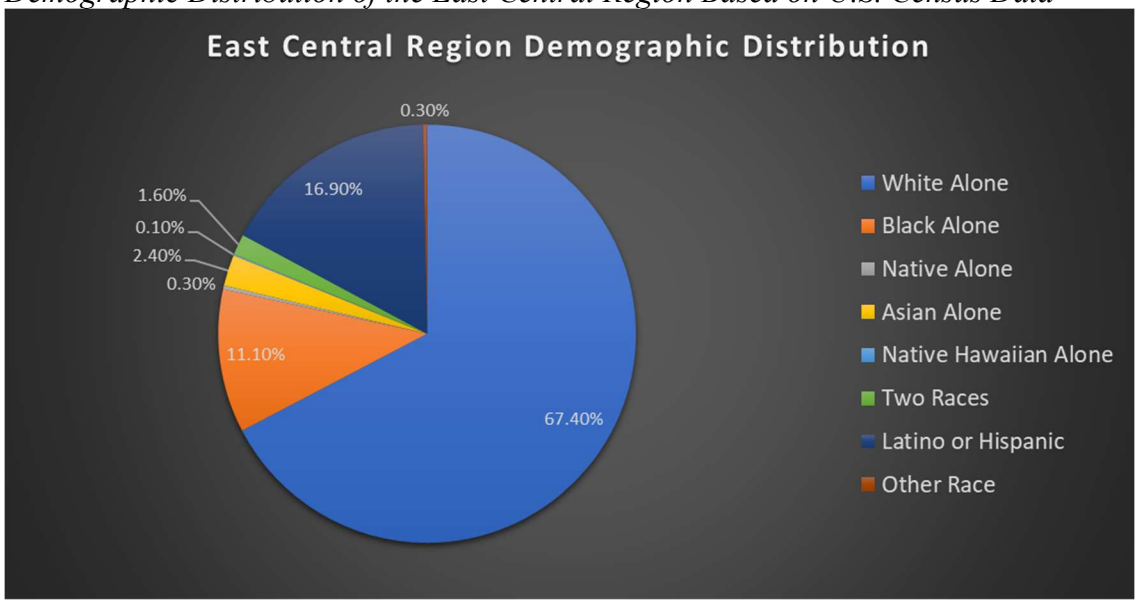


Note. Pie chart of the demographic distribution of the Northeast region of Florida. The data were provided by the U.S. Census Bureau (2018).

The East Central region has the following demographics: 67.4% White alone, 11.1% Black alone, 0.3% Native alone, 2.4% Asian alone, 0.1% native Hawaiian alone, 1.6% two races, 16.9% Latino or Hispanic, and 0.3% other race (Figure 5) (U.S. Census, 2018). Total population was 3,361,496 persons and 17.9% of the total population of the state (U.S. Census, 2018).

Figure 5

Demographic Distribution of the East Central Region Based on U.S. Census Data

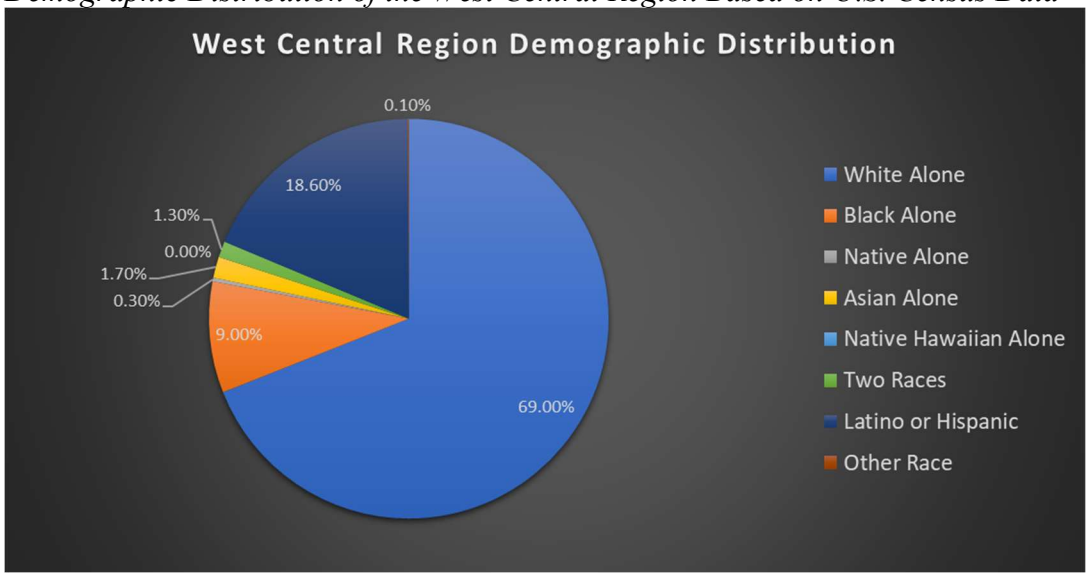


Note. Pie chart of the demographic distribution of the East Central region of Florida. The data were provided by the U.S. Census Bureau (2018).

The West Central region has the following demographics: 69.0% White alone, 9.0% Black alone, 0.3% Native alone, 1.7% Asian alone, 0.0% native Hawaiian alone, 1.3% two races, 18.6% Latino or Hispanic, and 0.1% other race (Figure 6) (U.S. Census, 2018). Total population was 4,248,998 persons and 22.6% of the total population of the state (U.S. Census, 2018).

Figure 6

Demographic Distribution of the West Central Region Based on U.S. Census Data

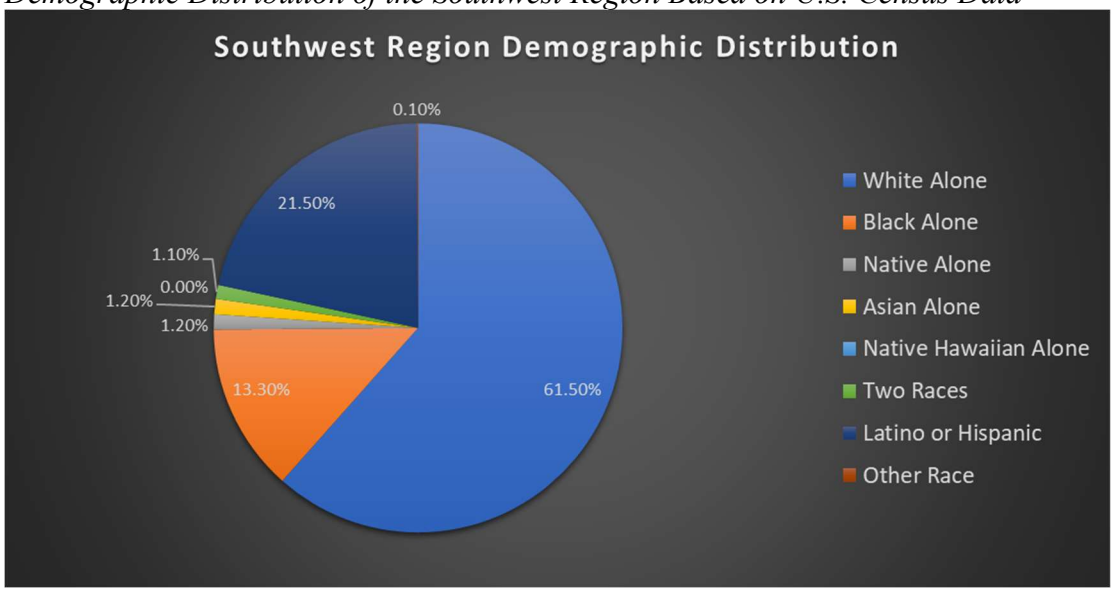


Note. Pie chart of the demographic distribution of the West Central region of Florida. The data were provided by the U.S. Census Bureau (2018).

The Southwest region has the following demographics: 61.5% White alone, 13.3% Black alone, 1.2% Native alone, 1.2% Asian alone, 0.0% native Hawaiian alone, 1.1% two races, 21.5% Latino or Hispanic, and 0.1% other race (Figure 7) (U.S. Census, 2018). Total population was 809,009 persons and 4.3% of the total population of the state (U.S. Census, 2018).

Figure 7

Demographic Distribution of the Southwest Region Based on U.S. Census Data

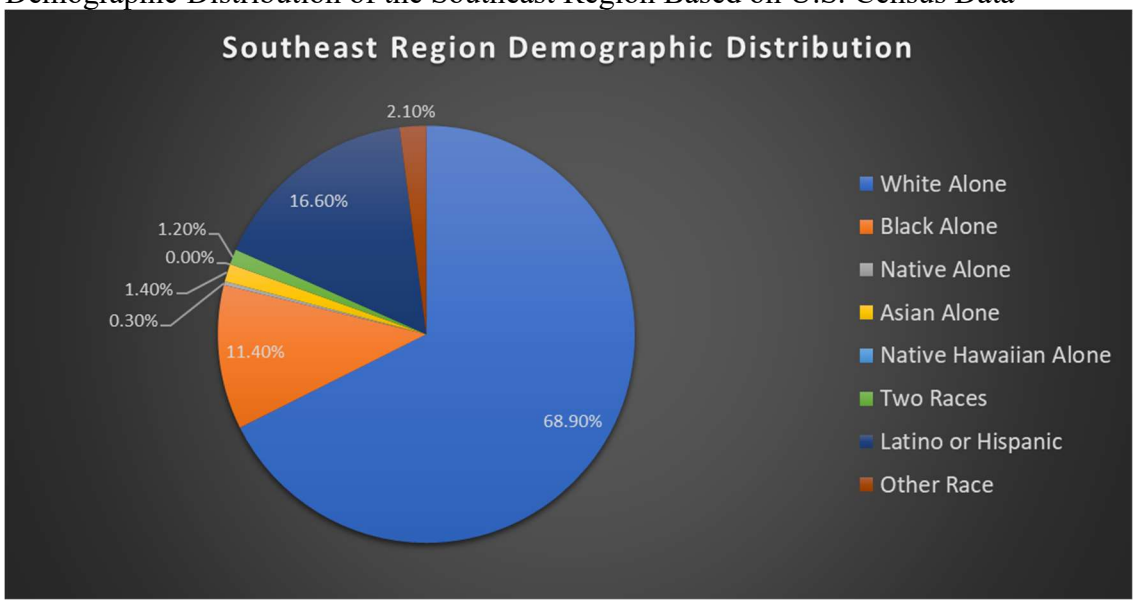


Note. Pie chart of the demographic distribution of the Southwest region of Florida. The data were provided by the U.S. Census Bureau (2018).

The Southeast region has the following demographics: 68.9% White alone, 11.4% Black alone, 0.3% Native alone, 1.4% Asian alone, 0.0% native Hawaiian alone, 1.2% two races, 16.6% Latino or Hispanic, and 2.1% other race (Figure 8) (U.S. Census, 2018). Total population was 1,922,265 persons and 10.2% of the total population of the state (U.S. Census, 2018).

Figure 8

Demographic Distribution of the Southeast Region Based on U.S. Census Data

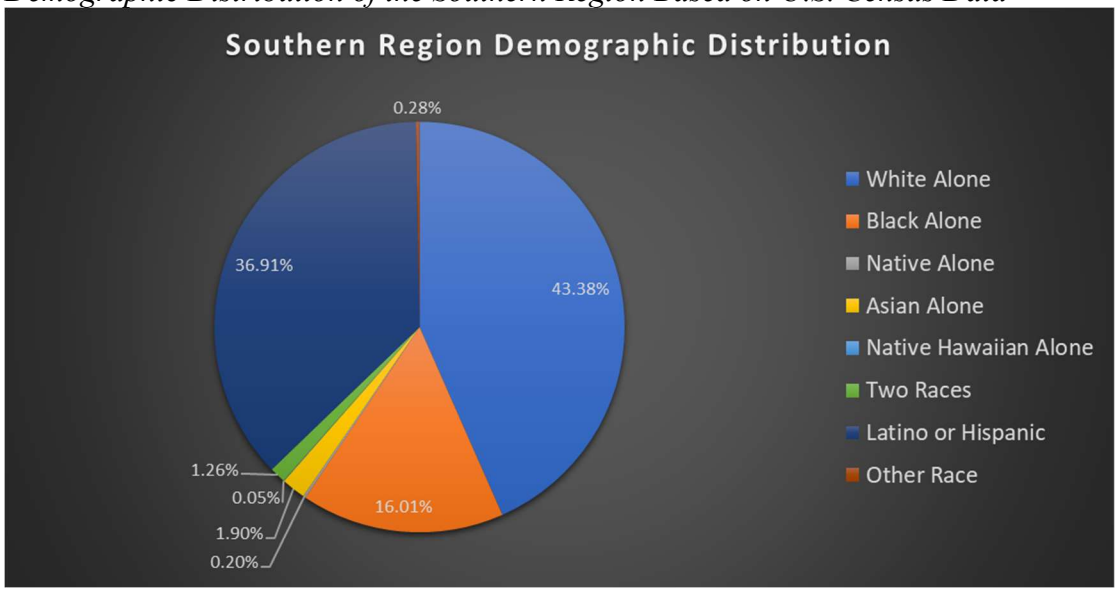


Note. Pie chart of the demographic distribution of the Southeast region of Florida. The data were provided by the U.S. Census Bureau (2018).

The Southern region has the following demographics: 43.38% White alone, 16.01% Black alone, 0.2% Native alone, 1.9% Asian alone, 0.05% native Hawaiian alone, 1.26% two races, 36.91% Latino or Hispanic, and 0.28% other race (Figure 9) (U.S. Census, 2018). Total population was 4,317,591 persons and 23% of the total population of the state (U.S. Census, 2018).

Figure 9

Demographic Distribution of the Southern Region Based on U.S. Census Data

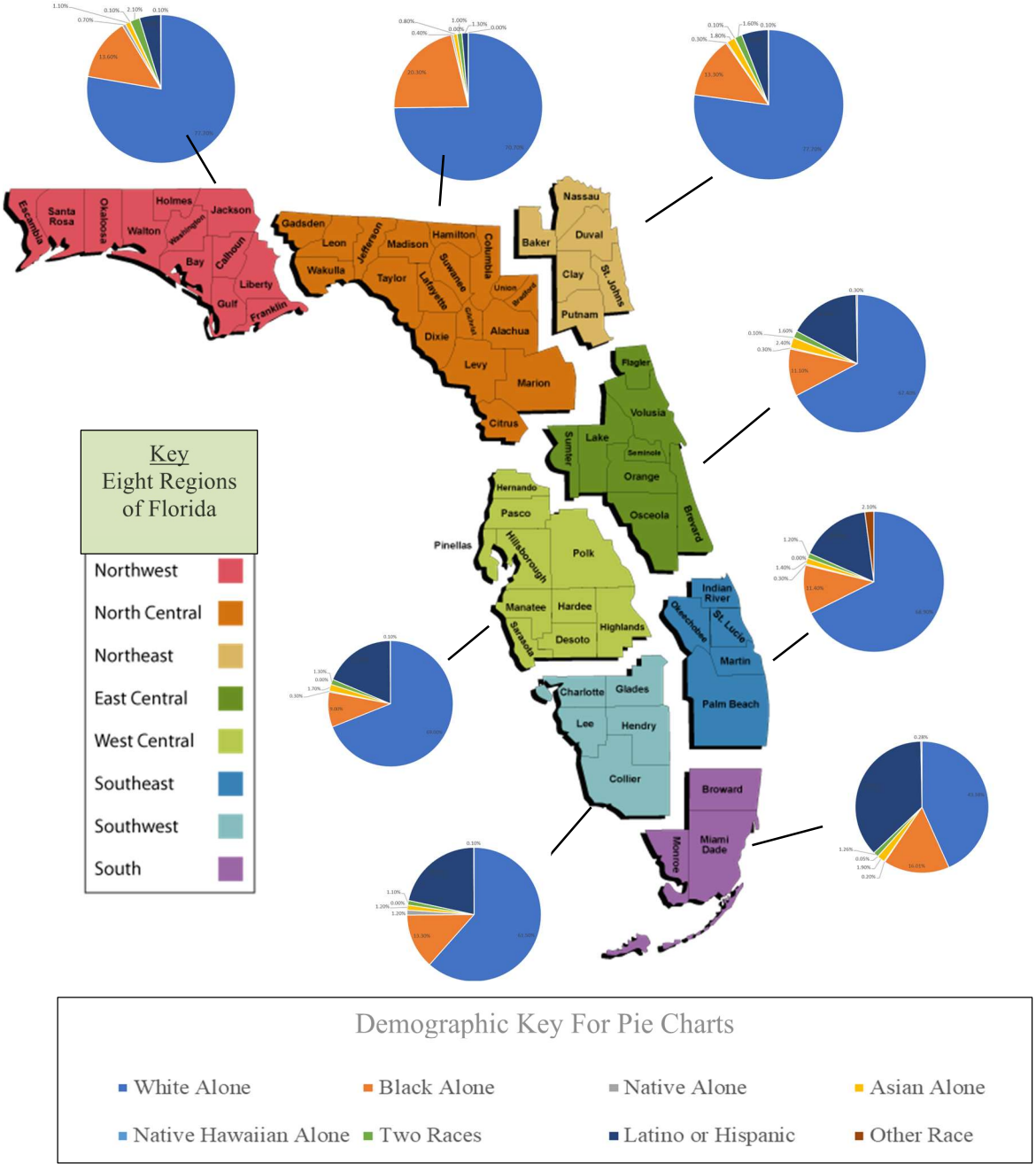


Note. Pie chart of the demographic distribution of the Southern region of Florida. The data were provided by the U.S. Census Bureau (2018).

From the census data there is a significant trend that shows an inclination towards ethnic diversity with significant increases in Latino populations and decrease in White populations towards the southern end of the state with less ethnic diversity and decrease in Latino populations towards the northern end of the state (Figure 10). Black, Native American, Asian, and two races seem to be relatively distributed evenly across the entire State.

Figure 10

Demographic Distribution of the Regions Based on U.S. Census Data



Each of the ethnic groups have ethnic sub-groups within them increasing the cultural diversity within the census. For example, those who identify as Latino may have cultural origins from Spain, Brazil, Puerto Rico, Colombia, Peru, Cuba, Mexico and the like. Each of these ethnic subgroups has its own unique culture and heritage (Molina, Phillips, & Sidanius, 2015). Their approach to topics such as family, health habits, sexual behaviors, and sexual knowledge can vary dramatically (Jackson, Karasek, Dehlendorf, & Foster, 2016). Florida in the near future, will have to delve a bit deeper with the approach on sexual health in relationship to sexually transmitted diseases (STD) as it pertains to the different populations per region across the State.

Gonorrhea in Florida

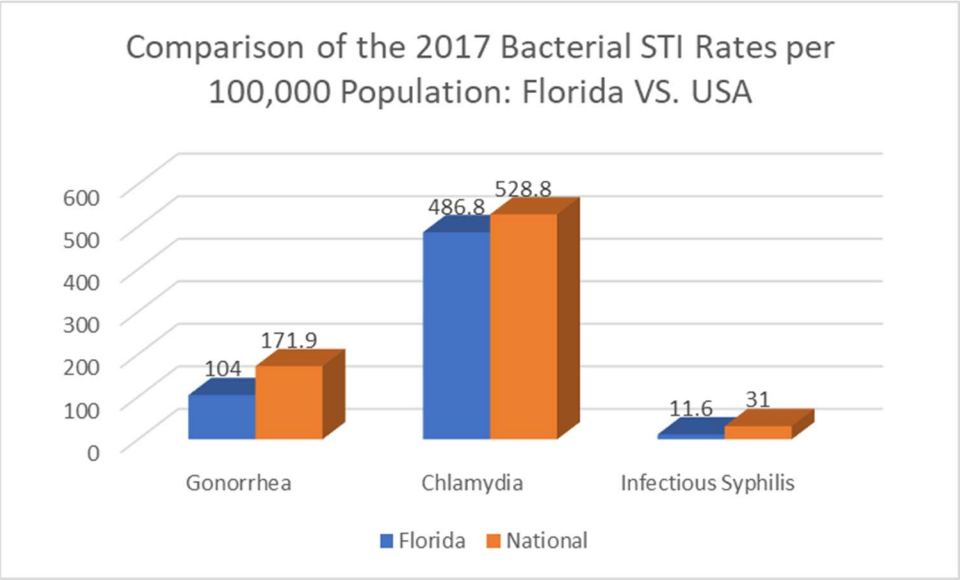
Florida has seen an increasing trend in gonorrhea infections. In 2017 there were 31,710 cases with a rate of 154.3 per 100,000 population (FL Health CHARTS, 2018). Six years earlier in 2011 there were 19,704 cases with a rate of 104.0 per 100,000 population. Over this six-year time frame Florida has seen a 60.9% increase in gonorrhea infections and a 48.4% increase in rates (FL Health CHARTS, 2018). Nationally in 2011 there were 321,849 reported cases of gonorrhea at a rate of 103.3 per 100,000 population and in 2017 there were 555,608 cases at a rate of 171.9 per 100,000 population. Over the six-year term the nation saw a 72.6% increase in cases and a 66.4% rate increase (Braxton et al., 2018). Although Florida is below the national trends none the less this is still a significant increase overall. In this same time frame, as a comparison (Figure 11), in Florida infectious syphilis had 1,257 cases in 2011 at a rate of 6.6 per 100,000 population and 2,391 cases in 2017 at a rate of 11.6 per 100,00 population (FL Health

CHARTS, 2018). This is a 90.2% increase in syphilis cases and a 75.8% increase in rates in the six-year period. Nationally there were 46,040 cases of infectious syphilis in 2011 at a rate of 14.8 per 100,000 population and in 2017 101,567 cases at a rate of 31.4 per 100,000 population (Braxton et al., 2018). There was a 120.6% increase in cases nationally and 112.2% increase in rate over the six-year period. Florida cases of Chlamydia in 2011 were at 76,050 at a rate of 407.3 per 100,000 and in 2017 there were 100,057 cases at a rate of 486.8 per 100,000 (FL Health CHARTS, 2018). This is a 31.6% increase in cases and a 19.5% increase in rates in the six-year time frame. Nationally in 2011 there were 1,412,791 cases of Chlamydia at a rate of 453.4 per 100,000 population and in 2017 there were 1,708,569 at a rate of 528.8 per 100,000 population (Braxton et al., 2018). Over the six-year period nationally there was a 20.9% increase in Chlamydia cases with a 16.6% increase in the rate.

Overall, Florida has been below the national levels for bacterial STD infection rates, but it has still seen a significant increase in cases and rates (Figure 12). The increases are large percentage jumps, which is disconcerting. In regard to gonorrhea this is an alarming trend. This trend can lead to the rapid evolution of completely drug-resistant gonorrhea strains. There is also been a greater increase of male infections vs. female infections in the same six-year period. Gonorrhea infections in males has increased 95.1% whereas in females the increase has only been 27.9% (FL Health CHARTS, 2018). The cause of this increase dramatically slanting towards the male population may be due to the behavior of the bacterium or ethnic and cultural reasons.

Figure 11

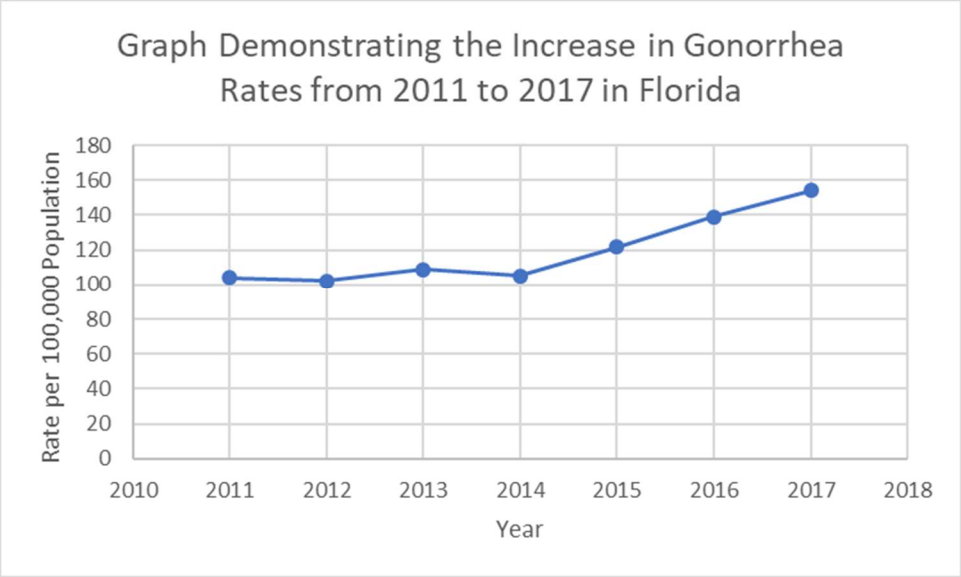
Comparison of the 2017 Bacterial STI Rates per 100,000 Population: Florida VS. USA



Note. Bar graph comparing Florida to the USA regarding bacterial STI rates. The data were provided by Braxton, et.al. (2018) and the Florida Department of Health (2018).

Figure 12

Graph of the Increase in Gonorrhea Rates in Florida Between 2011 to 2017



Note. Line graph demonstrating an increasing trend in gonorrhea rates in Florida between 2011 to 2017. The data were provided by the Florida Department of Health (2018).

Florida states that any sexually active person can contract gonorrhea through unprotected sex vaginally, anally, or orally (CDC, 2017). This is a generalized blanket statement that protects the state from any liabilities of not protecting the public. Although it is true that anyone can contract a gonorrhea infection, the state focuses primarily on sexually active men who are gay, bisexual, or have sex with men. The state also states that women who are sexually active under the age of 25 years or older women with certain risk factors such as multiple sex partners are also at risk (FL Health CHARTS, 2018). There is no focus on those who may be at risk for drug-resistant variants.

Drug-Resistant Variants and the state of Florida

The CDC monitors drug resistance through the Gonococcal Isolate Surveillance Program (GISP) (Kirkcaldy, 2016). As of 2016 there are 27 participating clinical sites that collect gonorrhea samples to be sent off for drug-resistant analysis (Kirkcaldy, 2016). The clinical sites cater to the local demographics of the area. After 2013 there are no more participating clinical sites in Florida (Kirkcaldy, 2016). Prior to 2013 there were two participating clinical sites, and they were Miami-Dade from 1998 to 2013 and West Palm Beach from 1987 to 1998 (Kirkcaldy, 2016). There is no current data for any area of Florida. The lack of participation of Florida in the monitoring of drug resistance is problematic. This means that Florida will have to rely on data from other monitoring locations to develop statewide interventions. The other option, is to utilize the mode of treatment as a determinate of who would be most likely to contract a drug-resistant variant and build a predictive model from mode of treatment in conjunction with most dominate group of infected individuals. Considering Florida is demographically diverse, the monitoring needs to come from within and not be based on other areas of the United States. Additionally, full drug resistance has occurred in March 2018. After 2013 and later, has been some of the most critically important years for the evolution of gonorrhea drug resistance (CDC, 2017).

Summary

It was aforementioned that there are two core approaches for studying *Neisseria gonorrhoeae,* its increasing antimicrobial resistance, and the way it is spreading through the population by human behavior. The surveillance approach is necessary to maintain

and gain the understandings of the origin of the infection; infection rates for past, present, and future; the location of the infections for past, present, and future; affected groups; and different drug-resistant variants. The findings of those research teams who conducted surveillance, all shared a commonality. The common findings in the simplest terms, is that cases of gonococcal infections are increasing. They are increasing at the local, national, and worldwide levels. Those findings also indicate that gonococcal infections are not limited to the three simplified groups of; men who have sex with men, workers in the sex trade, and pregnant women as identified by the WHO and the CDC. Gonococcal infections are spreading to other groups. The researchers also share findings that indicate a correlation between a lack of public education and the perpetuation of an increase in antimicrobial drug resistance cases.

From the conflicting literary works, it is possible that the CDC could be unintentionally misrepresenting the at-risk groups. The literature does clearly state that those who have gonococcal infections are at a greater risk for contracting HIV. This could possibly be the reason why the CDC has focused on men having sex with men as one of the at-risk categories for gonococcal infections. The second at-risk group that the CDC discusses are those working in the sex industry. One needs to take into consideration that prostitution is illegal in most of the United States. Because of this there are no routine health inspections nor sexual health safety training for these individuals. The lack of education and medical inspections only aides in the spread of the gonococcal bacterium. The final group targeted by the CDC are pregnant women. The CDC may be targeting this group because women can be asymptomatic, and that bacterium can easily

affect the fetus and a newborn child. The governmental representation of at-risk groups, in this instance appears to be contradictory to some of the findings in the literature. Unfortunately, the current presented information maybe misdirecting the public.

There is another aspect regarding the race to stay ahead of drug-resistant gonorrhea. Science needs to evaluate affective approaches that can control or kill the bacterium at the molecular level. Gonorrhea just like any other single celled organism has the same basic structures. Gonorrhea is diplococcus meaning there always two cells grouped together and the cells are round in shape. These cells are surrounded by gram negative phospholipid membrane. It is this phospholipid membrane that plays a role in drug resistance. Imbedded within the membrane are a series of trans-membrane proteins. These proteins control all the materials entering and exiting the cell. Often it is found in nature there may be some variances of a species that are naturally resistant. Through artificial directional selection those resistant strains survive and are the only strains left to reproduce. If a better understanding of the molecular pathways can be identified, a better drug delivery at the molecular level can be incorporated.

Antimicrobial resistant gonorrhea is a rarely publicly discussed sexually transmitted infection. This lack of discussion is ironic considering that gonorrhea is the second most reported sexually transmitted disease in the United States as well as being extremely resilient with amazing adaptability to almost any environment. The aptitude is for it to adapt to almost any environment and quickly embed the adaptions within its genomic code. It also has the ability to receive and donate different segments of its and other's genomic code. This is conducted between other species within the genera as well

as to its own species. The bacterium does not need to go through asexual reproduction and hope a mutation occurs, it can just pass segments of its code through the method of conjugation and transference. This rapid transfer gives gonorrhea the ability to gain antimicrobial resistance almost instantaneously provided the correct genomic code exists.

Gonorrhea is becoming a "super bug." The CDC and WHO have stated that gonorrhea may soon become completely drug resistant. If this happens, the United States and the world will be facing the next great epidemic. In March 2018 with the emergence of the first case of completely drug-resistant gonorrhea may be an indication that this epidemic is just around the corner. It is unknown if any new antimicrobials that can fight gonorrhea will be entering the market in the very near future. As of now there is only one effective treatment and it is believed that there are only a few years left before becomes that treatment becomes ineffective. The first instance of this was documented in January of 2019 where two unrelated women who contracted gonorrhea were unable to be affectively treated with the current recommended treatment protocol. One thing is for certain, there are other at-risk groups beyond men having sex with men, individuals who work in the sex trade, and pregnant women. Review of the literature indicates that there is a significant lack of research at the regional level. These at-risk groups need to be identified at the regional levels and targeted interventions will then need to be developed.

Chapter 3: Research Method

Introduction

The purpose of the study was to identify which category or categories of individuals in each Florida region were most likely to contract drug-resistant strains of *N. gonorrhoeae.* The study used data collected from 2007 to 2018. From this data, infectious trends were evaluated and determined. Due to the nature of the bacterium and its ability to share genomes, identification of the at-risk groups can be determined based on use of last-line-of-antibiotic-defense.

This quantitative study used secondary data provided by the FDOH Bureau of Communicable Diseases. Since gonorrhea infections are mandated as a reportable communicable disease, the FDOH independently and continually collects gonococcal infection data; the Federal government collects similar data through the Gonococcal Isolate Surveillance Project (GISP) (CDC, 2012). The advantage of using secondary data is that that the information has already been vetted and passed governmental IRB protocols. The use of secondary data significantly lowers the research costs and often provides large scale data.

Research Design and Rationale

The approach to this study determined what variables were useful from the existing secondary data to identify those who are at risk for contracting drug-resistant strains of gonococcal bacteria. The outcome is already known. What was not known was the variables that caused this outcome. The methodology (discussed later in this chapter) was designed to discover the causes of the outcome. Since the demographics in Florida

vary regionally, it was assumed that the risk factors (significant variables) in each region would also vary. In order to determine which variables were significant, a series of questions were answered. From those answers, predictive, regionally focused models were constructed. This information can be used to develop applicable and more successful preventative interventions. The data were analyzed swiftly. Since this study used secondary data, the data points already existed and thus it was completed within a short timeframe.

Methodology

Florida is divided into 67 counties (U.S. Census, 2017). These counties were grouped into eight regions for this study. Grouping the counties into regions provided enough data points to be statistically significant. This study utilized existing secondary data provided by the state of Florida. Data from the Gonococcal Isolate Surveillance System (GISP) from the Federal government was going to be used as a comparison for drug-resistant strains. But the GISP data were limited and could not be effectively used as a comparison, because Florida closed its only collection site for monitoring drug-resistant strains in 2013, and thus was no longer participating in GISP drug-resistant data collection.

Florida uses two systems to house its data. The first is CHARTS, which is open to the public with limited accessible data points. The second is STARS, which requires permission from the state to access but has a much greater source of data points. CHARTS allowed for a general understanding of the need for this study. STARS is a

more in-depth data source, which provided a more focused study. Each system has its benefits but also has its limitations. These will be discussed later in this chapter.

CHARTS

The Florida (CHARTS) system. Within this system there is limited information available but there is enough information to use for generalizations. This data set is directly available to the public with interactive capabilities. Regarding gonorrhea infections, CHARTS provides sex, race, and age for each county and statewide in an interactive format. It lacks the necessary detailed information such as mode of treatment, religion, sexual behavior, drug use, and the like. It also lacks the raw data for additional statistical manipulation, and it limits the user to only building graphs, charts, and rates.

STARS

Florida STARS is a database of all reportable diseases and the associated demographics with the disease. Gonorrhea is considered a reportable disease and is in the data base. STARS host the raw gonorrhea data as well as over 100 different data points regarding gonorrhea infections in the State. The system is highly restricted and in order to access the information one must either be an employee of the Florida Department of Health or be granted permission by the FDOH through a contractual agreement. In prior email and phone discussion with representatives of the FDOH it was confirmed that access to this data base was available provided a data use agreement is signed, a proposal is submitted including Walden's IRB approval, and FDOH's IRB equivalent approves. The data was provided and as part of the agreement, the FDOH requires all data destroyed after the study is completed and all findings must be shared with the FDOH.

GISP

The Gonococcal Isolate Surveillance System (GISP) is the federal system that has national information regarding gonococcal infections. The GISP has data regarding only one Florida county; of which that data is directly related to drug resistance. Regrettably the collection site was closed in 2013 so there is no current data regarding drug resistance in Florida. GISP also has data from 27 other national clinics that have been testing for drug resistance which could be used for comparison. Unfortunately, GISP clinical sites do not test everyone for drug-resistant variants but only test those that have been deemed to fall within the at-risk categorization. This limited testing may be driven by cost, but also limits the chances of discovery in other potentially at-risk groups. The GISP data could not be used for this study.

Secondary Data from the State of Florida

Florida has in its data base 20 years of gonococcal surveillance. This study only used the last 12 years (2007 to 2018) of data due to what was available and complete from the FDOH. Considering there has been an upward trend in infections in the last 5 years (Figure 12) as well as a strong evolution towards drug resistance in the last decade, this provided a historical base to build from. Based on the GPower calculation the minimum number of data points required for significance for a two tailed multiple logistic regression calculation at a $p<0.05$ requires a minimum sample size of 89, for a comparison among the means; 210, and F test; 279. Using 12 years of data provided enough power for statistical significance. It is financially unfeasible to conduct a one-year study of this magnitude, let alone a 12-year study. Due to the significant cost and

IRB concerns, the data provided by the state was cost effective and has already been vetted through the State's equivalent of an IRB for the data collection. The data usage required more than one IRB evaluation.

Regional Distribution

Florida itself is divided into 67 counties (U.S. Census, 2017). A Power calculation was conducted. Based on that calculation, individual counties did not hold enough data points for statistical significance. In order to obtain statistical significance base on the GPower calculation, the counties were grouped into the eight regions (Figure 1) and the last eleven years of data were compiled for each of those regions. The Northwest region included Escambia, Santa Rosas, Okaloosa, Walton, Holmes, Washington, Jackson, Bay, Calhoun, Gulf, Liberty, and Franklin counites. The North Central region hosted Gadsden, Leon, Wakulla, Jefferson, Madison, Taylor, Lafayette, Hamilton, Suwanee, Dixie, Columbia, Gilchrist, Union, Bradford, Alachua, Levy, Marion, and Citrus counties. The Northeast region consisted of Nassau, Baker, Duval, Clay, Putnam, and St. Johns county. The East Central region included Sumter, Lake, Flagler, Volusia, Seminole, Orange, Osceola, and Brevard counties. West Central region has Hernando, Pasco, Pinellas, Hillsborough, Polk, Manatee, Sarasota, Hardee, Desoto, and Highlands counties. The Southwest region hosted Charlotte, Glades, Lee, Hendry, and Collier. The Southeast region included Indian River, Okeechobee, Saint Lucie, Martin, and Palm Beach counties. The Southern region has Broward, Monroe, and Miami-Dade counties.

Data Analysis

This quantitative study utilized secondary data provided by the FDOH. The provided data contained over 37 million data points, 82 risk factors, and 16 demographic factors. The majority of the data provided was categorical data and was listed by county. When applicable, data that was not categorical such as age was converted into categorical data by grouping. For instance, ages were grouped into age ranges. Within the categorical data the responses were coded so that IBM SPSS could conduct the statistical calculations (see Table 1). Each region was compared to each other region as well as being compared to Florida as a whole. The extremely sensitive data, such as addresses, was request but denied. Had the data been provided by the FDOH then spatial mapping would have been incorporated using ArcView Geographical Information Systems (GIS).

The data analysis was conducted in a series of methodical stages so as to systematically narrow down to the identifiable at-risk and demographic groups per region. The data were assessed for missing data points. Any missing data points were evaluated individually for inclusion or exclusion in the study. Once the data were evaluated for completeness, the data were then evaluated to identify statistically significant risk factors in each region and the state overall. Risk and demographic factors that were not determined complete or significant were removed from further analysis. The FDOH provided the last-line-of-antibiotic-defense data, thus a final analysis was conducted comparing the methods of treatment.

There were 33 independent variables consisting of demographic data and risk factor data that was identified as usable (see Table 1). After the variables were identified,

they were evaluated for significance at state and regional levels using Chi-square, cross-tabulation, and multiple logistic regression calculations as applicable. All 33 independent variables were used at both the state and regional levels. Because there was only one currently recommended prescribed treatment that is considered the last-line-of-antibiotic-defense against gonococcal infections (variable 34), the reported prescribed mode of treatment was evaluated for significance and was used as the dependent variable. The evaluation was conducted at the state and regional levels inclusive of a comparison between the state and regional levels. The statistically significant reported last-line-of-antibiotic-defense was then compared to the statically significant risk factors to evaluate any relationships. This was conducted at the state and regional levels inclusive of a comparison between the state and regional levels. The final narrowed resulting data were analyzed using chi-square, cross tabulation, and logistic regression modeling in IBM SPSS. The final results were used to predict which factors would contribute to future drug-resistant infections. The literature has elucidated that prescribed last-line-of-antibiotic-defense are a factor in driving drug resistance. The statistically significant reported last-line-of-antibiotic-defense was the dependent variable, and the risk and demographic factors are the independent variables in the final calculations.

Table 1

Demographic and Risk Factor Data Types and Data Coding

Factor	Data Type	Data Coding
Gender	Categorical	1 = Female, 2=Male
Sexual Orientation	Categorical	1 = Heterosexual, 2 = Bisexual,

		3 = Homosexual
Race/Ethnics	Categorical	1 = Black/African American, 2 = Hispanic, 3 = White Non-Hispanic, 4 =Asian Non-Hispanic
Pregnancy	Categorical	1 = No, 2 = Yes
Initial Antibiotic Treatment	Categorical	1 = Last-line-of-antibiotic-defense, 2 = All Other Antibiotics
Age Range	Categorical	1 = 16-19 yrs., 2 = 20-24 yrs., 3 = 25-29 yrs., 4 = 30-34 yrs., 5 = 35-39 yrs., 6 =40-44 yrs., 7 =45-49 yrs., 8 = 50-54 yrs., 9 = 55-59 yrs., 10 = over 60 years
Number of Sex Partners (A.K.A. Multiple Partners)	Discrete	Numerical thus numbers were as reported.
Drug Use	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Intoxicated; Alcohol or Drug	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Always Used Condoms	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Sometimes Used Condoms	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Never Used Condoms	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Condom Use with Main Partner	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Condom Use with Other Partner	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Anonymous Partner	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Meet Through the Internet	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
New Partner <90 days	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Met Partner in Bar	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Met Partner in Bath	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Knew self-HIV status	Categorical	1 = Yes, 2 = No, 3 = Unknown
Paid for Sex	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer

Was Paid for Sex	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Vaginal or Anal with Woman	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Oral Sex with Woman	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Unprotected Sex with Woman	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Vaginal or Anal with Man	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Oral Sex with Man	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Unprotected Sex with Man	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Men Having Sex with Men	Categorical	1 = Female, 2 = MSM, 3 = Male Heterosexual
Had a History of STD's	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Has had an STD in the last 12 Months	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Incarcerated in the Last 12 Months	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer
Sexual Assault	Categorical	1 = Yes, 2 = No, 3 = Refused to Answer

Data Analysis per Research Questions

This study intended to identify the at-risk groups for contracting drug-resistant gonorrhea on a per region basis in Florida through the evaluation of current prescribed last line of antibiotic treatments and gonococcal infection risk factors. The data were normalized to rates, either per 1,000 or 100,000 as appropriate. The data were accumulated by the previously defined Florida regions. The GPower calculations indicated different minimum sampling sizes depending on the type of statistical calculation utilized. The rates were computed for each available classification (see Table 1). The variables were then used to answer the following research questions.

Research Question 1: Are there differences in using last-line-of-antibiotic-defense between Florida as a whole and each of the eight regions?

Hypothesis 1:

H_0*:* There is no statistical significance between each of the eight different regions and Florida as a whole for the last-line-of-antibiotic-defense associated with gonococcal infections.

H_a*:* There is a statistical significance between each of the eight different regions and Florida as a whole for the last-line-of-antibiotic-defense associated with gonococcal infections.

Data Analysis 1:

Chi-square and cross tabulations were conducted to compare the last-line-of-antibiotic-defense between Florida as a whole and the eight different regions.

Research Question 2: Are there differences in using last-line-of-antibiotic-defense among the eight Florida regions?

Hypothesis 2:

H_0*:* There is no statistical significance between the eight Florida regions in regard to the last-line-of-antibiotic-defense for gonococcal infections.

H_a*:* There is a statistical significance between the eight Florida regions in regard to the last-line-of-antibiotic-defense for gonococcal infections.

Data Analysis 2:

Chi-square and a cross tabulations were conducted to compare the last-line-of-antibiotic-defense between the eight different regions.

Research Question 3: What are the statistically significant factors associated with being treated with last-line-of-antibiotic-defense in each of the eight regions and the state of Florida?

Hypothesis 3:

H_0*:* There are no statistically significant factors associated with being treated with last-line-of-antibiotic-defense in the eight regions.

H_a*:* There are statistically significant factors associated with being treated with last-line-of-antibiotic-defense in the eight regions.

Data Analysis 3:

Multiple logistic regression models were conducted for all 33 independent variables and the one dependent variable for each of the eight regions and Florida as a whole.

Current Gonococcal Infection Distribution

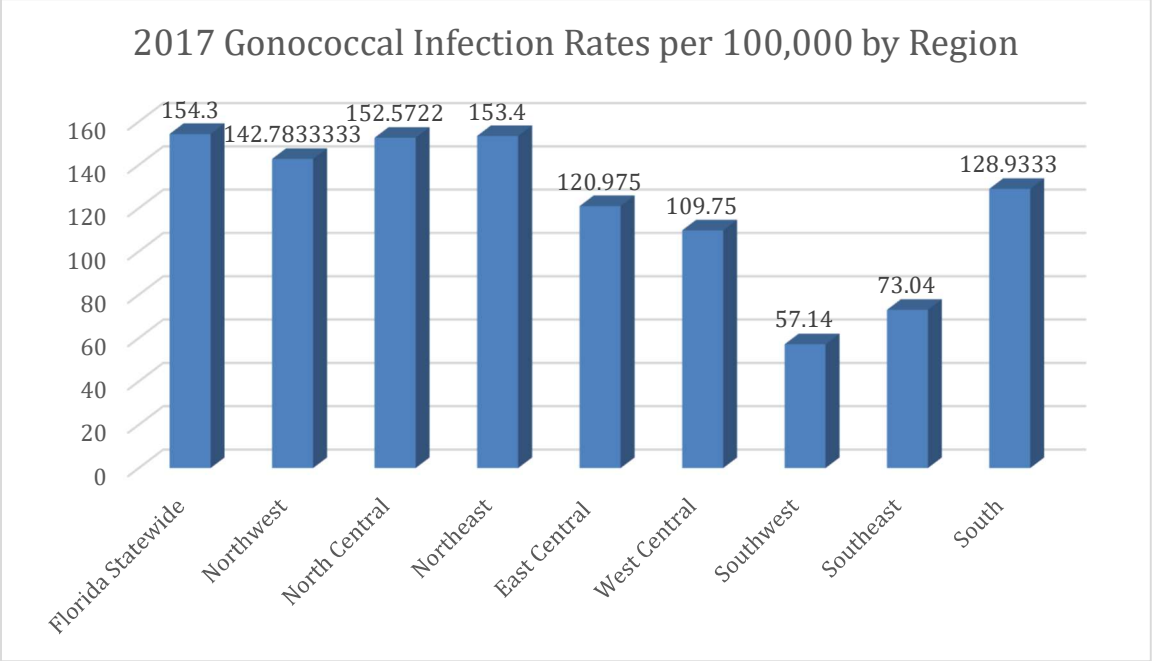
Not all gonococcal data for Florida is available without special request. The current freely accessible information through the Florida Department of Health CHARTS is gender, age, race, ethnicity, and county. The number of infections and rates are only stored to the last twenty years from the presence. This study is limited its evaluations between 2007 to 2018 which incorporated time before and after 2013 when the gonorrhea rates went on the rise. In addition, rates for 2019 were not available at the time of this study. As discussed before, Florida follows the current CDC guidelines of identifying at risk groups as being men having sex with men, sex workers, and pregnant women. None of this data is available on the open access of the CHARTS site. The FDOH data

dictionary was made available for this study. Within the dictionary there was evidence of more inclusive information such as sexual behavior, sexual orientation, drug use, demographic data, and treatment data. The actual data were made available upon written request and IRB approval from both Walden University and the Florida Department of Health.

The data available to the public is limiting. From the CHARTS system, on a Statewide basis, there is an upward trend of gonococcal cases. Using the most recent available data through CHARTS, the 2017 overall the rates of gonococcal infection vary among the regions (Figure 13). This indicates that infected groups are not uniform ally diluted throughout the State, which elucidated that there is a definitive demographic influence on gonococcal infections. The data also indicated that there appears to be significant infection rates within the non-Hispanic Black groups compared to non-Hispanic White and Hispanic groups (Figure 14). Unfortunately, there is no other public data to evaluate if the CDC recommendation are applicable at the regional level for the state of Florida. From what publicly available data there is, evidence exists that the at-risk groups were not what the CDC is reporting at the national level. This was found to be true and Florida will need to change its limited intervention approach to a more targeted regional approach.

Figure 13

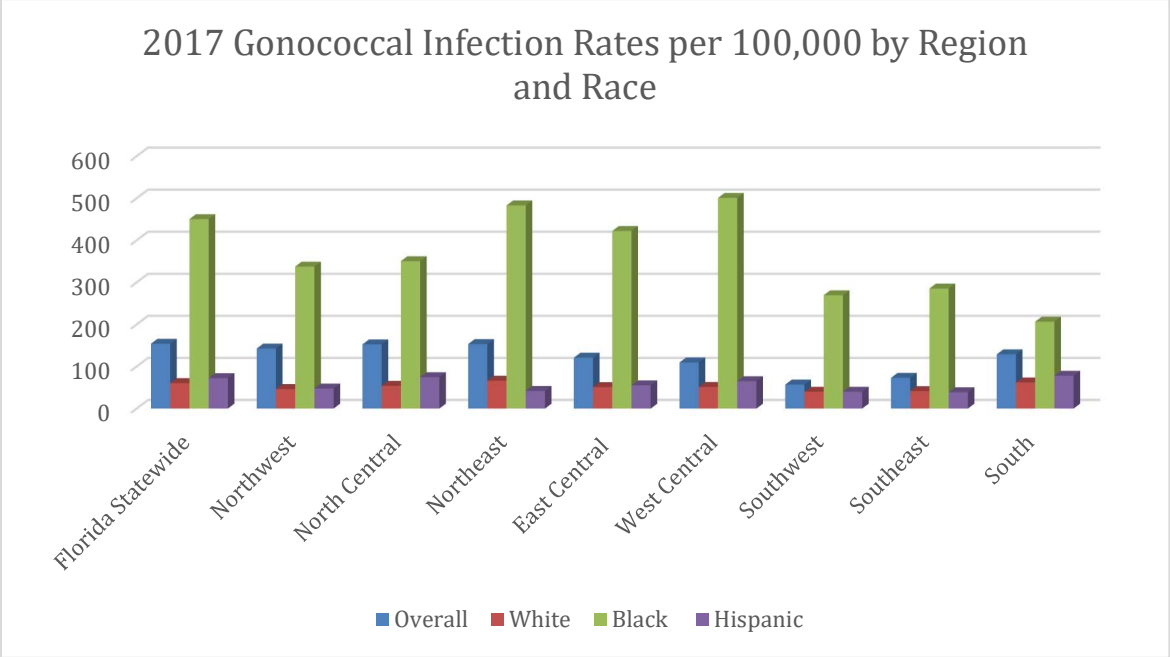
2017 Gonococcal Infection Rates Per Region



Note. Depicts gonococcal infection rates among the eight regions of Florida and Florida Statewide. Image created from public data proved by FDOH CHARTS system.

Figure 14

2017 Gonococcal Infection Rates Per Region



Note. Depicts gonococcal infection rates among the eight regions of Florida and Florida Statewide based on race. Image created from public data proved by FDOH CHARTS system.

Data Criteria

The study population was all individuals who have been diagnosed and reported as testing positive for *Neisseria gonorrhoeae* in the state of Florida. The data points that were requested and provided included; tested positive for gonococcal infection, sexually transmitted disease history (STD), race, ethnics, age, pregnancy, county of residence, gender, self-reported gender, sexual orientation, number of sex partners, treatment protocol, prescribed last-line-of-antibiotic-defense treatment and risk factors. Data that was also requested but was not provided due to confidentiality or other concerns from

Florida were city of occurrence, addresses, zip codes, neighborhood codes, and birth year.

Threat to Validity

External

As previously discussed, this study used secondary data acquired from the state of Florida. Since the data is not directly collected as would be in a primary data study, there may have been some unanticipated introduced bias. It is this bias that could threaten the validity of this study. The collected data is only as valid as the individual entering the information into the system. It was assumed that the process in which the data were entered is designed to be simple and easy. At times, the data may contain omissions or entered incorrectly. The recording of the data may potentially threaten the validity of the study. Although gonorrhea is considered a reportable disease, a medical professional may opt to not report the information with the expectation of protecting doctor-patient confidentiality. The failure to report all data points as required, creating data gaps through omission, may occur and be in part due to lack of time or failure to question the infected individual fully. Data that may have omission errors or appear to be collected incorrectly was evaluated to determine if the particular omission would affect the outcome. If it affected the outcome, that information was omitted from the evaluation and was noted in the results and discussion sections of this study.

Internal

For this study a data dictionary was acquired. Review of the data dictionary indicates that there were significant number of potential points of interest to compare.

The information was narrowed down. During the narrowing process confounders may have been overlooked. These confounders might be significant and the failure to incorporate them could affect the validity of the study. To correct for this potential, all data categories were evaluated against each other. Although this may be tedious it was necessary so as to confirm the results are valid. Another internal threat to validity was the number of data points available creating invalid and non-statistically significant results. In order to reduce this threat, counties were grouped into regions and data over the last 12 years was utilized. This provided enough Power to produce valid results.

Ethical Procedure

The data provided from the FDOH does not contain the names of the individuals. The names are coded and held with the FDOH. As per the FDOH data use agreement, the data were kept in a protected location and was only accessed by the approved principal investigator (PI). The data were not accessible by anyone who had not been approved by the FDOH. The data were kept in a locked file by the PI when not in use and any computer-based information was encrypted with access by only the PI. Once the study was completed the data were destroyed per the FDOH agreement (Agreement No. 2019-082). The FDOH required an IRB review and approval prior to their IRB review and approval. Thus, a Walden University IRB review was conducted, and the approval, number 04-24-19-0304414, was submitted to the FDOH along with the FDOH data use agreement application package.

Summary

This quantitative study used secondary data provide by the state of Florida. The data were vetted through the State's IRB and checked for validity. Although the state confirms the validity of its data there was always the chance some data points may have been missed. This study also reviewed the data provided and reviewed it for validity. The state provided data is broad reaching and provides informational data points that would be otherwise impossible to obtain without significant financial investment, years of collection, and a massive team of trained researchers to collect the data. Review of the data dictionary and subsequence review of the data itself elucidated a comprehensive collection of information. This study was limited to the data available and there was no mechanism to be able to return to the individual if further questions arise. The GISP data were extremely limited and only used for basic referencing since it is not as comprehensive as the data provided by the state of Florida. The GISP data were not incorporated into this study. The state did not restrict access to any of the non-identifiable data that was available such as mode of treatment, location, sexual behavior, drug use, sex, race, ethnics, and the like. Through evaluation of the state provided data, patterns emerged indicating what regional groups will be at-risk for contracting drug-resistant variants of gonorrhea.

Chapter 4: Results

Introduction

Gonococcal infections have been on the rise in recent years. These increases are predicted to lead to an increase in drug-resistant variants. The understanding of who is at risk for drug resistance is critical in creating targeted interventions. These interventions will lead to a reduction in overall infections, which should also have an effect in reducing drug-resistant strains. Florida limits their targeted interventions based on national statistics and recommendations from the CDC. Although the CDC does state overarchingly that all sexually active individuals are at risk for gonococcal infections, they specifically mention three groups: men who have sex with men (homosexual or bisexual men), pregnant women, and sex workers. These identified groups are based on national statistics, which do not always match Florida findings or Florida regions within the state findings. Florida, as a whole, is not an across-the-board representation of the demographics of the United States. Florida demographics change dramatically from North to South. Each demographic group approaches sexual behavior differently. It is necessary to evaluate each region to gain a better understanding of the driving forces for gonococcal infections and how antimicrobial treatments are rendered. This information can then identify who would be most likely at risk for contracting drug-resistant variant of gonorrhea. From these findings, a more targeted regional approach can be created. This would be more effective than using the national recommendations as the standard.

Data Collection

This quantitative study used secondary data provided by the FDOH through the STARS system under a contractual agreement. Over 37 million data points were available, spanning 78 FDOH-identified risk factors. The data provided included all available demographic data and all available risk factors from 2007 to 2018. This is the most recent and complete information available. The FDOH did not provide data for individuals under the age of 16 years. A telephone discussion with a representative of the FDOH elucidated that under the age of 16 years indicated nonconsensual sexual contact with a minor. Such data is considered sensitive and thus was excluded from the data provided.

Data Evaluation

The over 37 million data points provided were obtained in string text format. The data were converted into categorical data in Microsoft Excel and then imported into IBM SPSS (Version 25) for analysis. The data were further separated into regions, as outlined in Figure 1. Although rare, line segments with missing data were excluded from the calculations. Many of the variables presented as FDOH-identified factors had sections of "did not ask" or "refused to answer" as a response. Those responses were excluded from calculations as necessary and reported as such. Considering the magnitude of the available data and that there were very few missing data rows, the rejection of missing data or the inclusion or exclusion of "did not ask" or "refused to answer" when necessary did not affect the overall results. On the contrary, it provided clarity in the weakness in the data collection process. Seventy-eight risk factors were evaluated, repetitive ones

were excluded or combined into single groupings. For instance, risk factors such as “used heroin” or “used cocaine” were combined into “used drugs.” Risk factors included information such as drug use, number of sexual partners, condom use, type of sexual contact, and the like. It was found, that quite often within all of the risk factors, the data collector “did not ask” or the participant “refused to answer.” Data were evaluated at the statewide and regional level. Data that were found to be not statistically significant were eliminated from the final analysis and excluded from reporting. Only statistically significant data and results of interest were included in this study.

Dependent Variable

This study focuses on predicting the at-risk groups anticipated to contract drug-resistant strains of gonorrhea. Drug resistance occurs through the repetitive exposure of a bacterium to an antibiotic. Considering that there are only a select few antibiotics that are effective for the treatment of gonococcal infections, it is understood that there is limited time until the bacterium becomes resistant to these last-lines-of-antibiotic-defenses. The dependent variable for this study is reported gonococcal infections that required the last-line-of-antibiotic-defense. The antibiotic data were grouped into two categories (Table 1). The results of the evaluated data are summarized in the following sections and are based on the three proposed research questions.

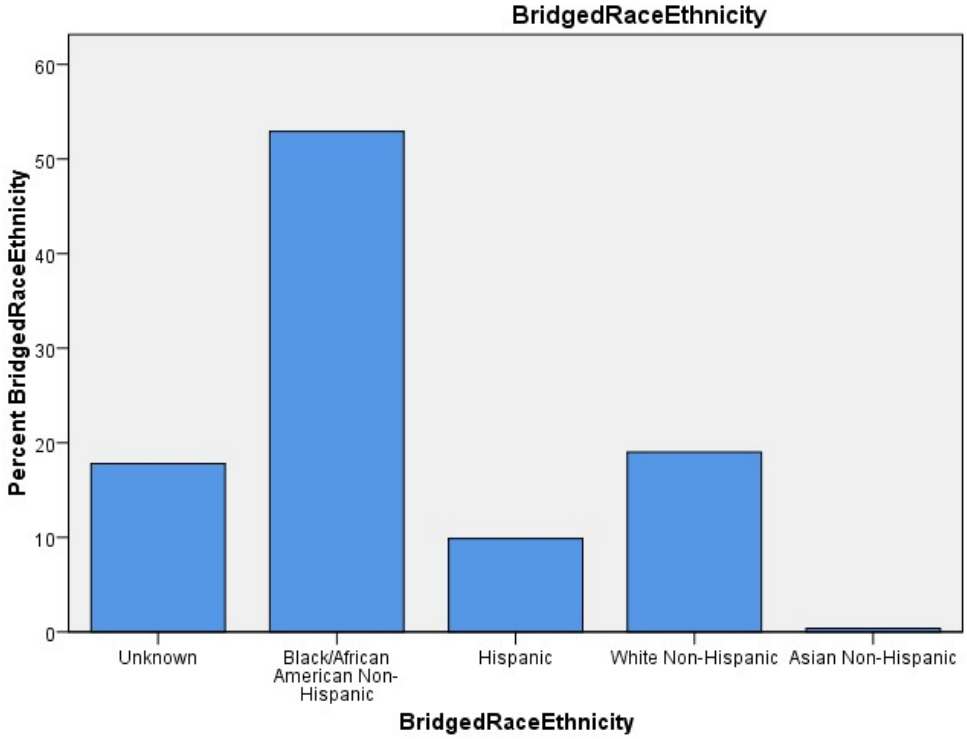
Florida Descriptive Statistics

Statewide more males (52.5%) than females (47.3%) were infected. The difference between the sexes overall is only a few percentage points indicating the male to female distribution across the state is relatively equal. Of the infected, only 8.6% were

males who had sex with males (MSM). Indicating on a statewide level, infections affected those males who identified as heterosexuals more than men who have sex with men (homosexual or bisexual). In regard to sexual orientation, 71.3% of the cases were reported as unknown. Of 28.7% reporting their sexual orientation (81,106 individuals), regardless of being female or male, 74.2% considered themselves heterosexual, 22.95% homosexual, and 2.84% bisexual. Again, indicating that gonococcal infections are more prominent in heterosexual populations. Race/Ethnicity are a factor in gonococcal infections (Figure 15). Black/African American Non-Hispanic are 52.9% of the gonococcal infections followed by White Non-Hispanic (19%), Hispanic (9.9%), Asian Non-Hispanic (0.4%), and unknown Race/Ethnicity (17.8%).

Figure 15

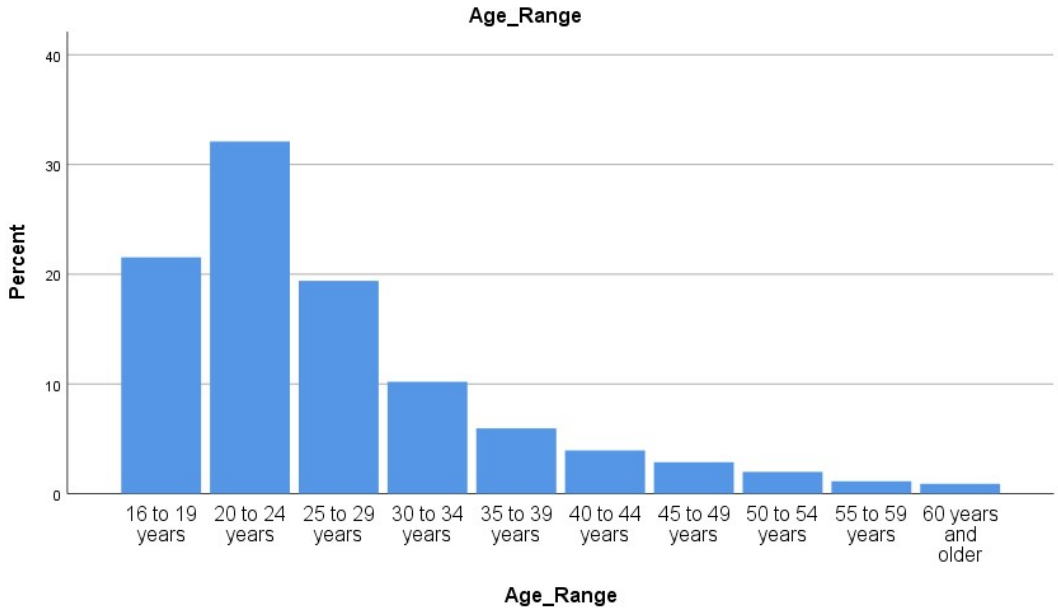
Percentage of Gonococcal Infections Per Race/Ethnicity Statewide



The results indicate that young adults under the age of 30 years made up the majority of infected individuals. The data can be further expanded into the 5-year age categories. Ages 20 to 24 years made up 32.1% of all those infected, followed by 16 to 19 (21.5%), 25 to 29 (19.4%), 30 to 34 (10.2%), 35 to 39 (5.9%), 40 to 44 (3.9%), 45 to 49 (2.9%), 50 to 54 (2%), 55 to 59 (1.1%), and over 60 years (0.9%) (Figure 16).

Figure 16

Percentage of Gonococcal Infections Per Age Group Statewide



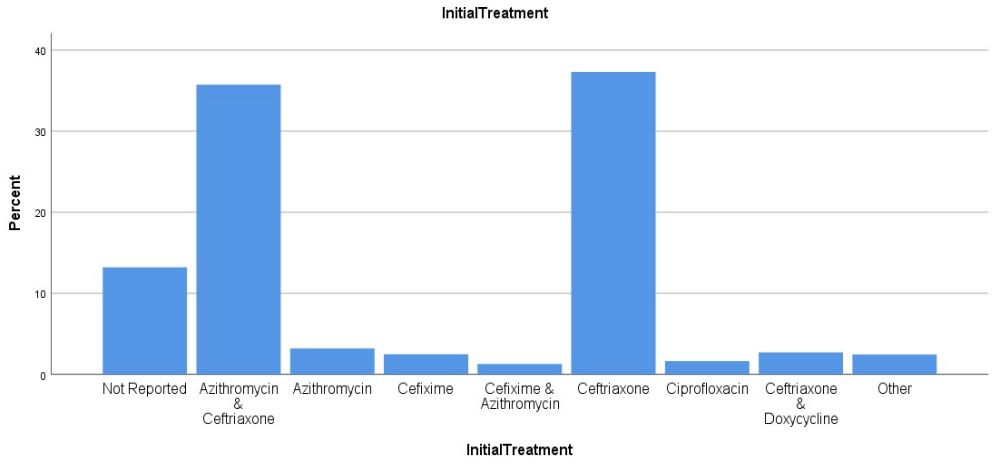
Pregnancy did not appear to be a determining factor regarding gonococcal infections. Of the infected women, only 14.4% of the women infected were pregnant. Although on the national level pregnant woman are considered as one of the at-risk groups for gonococcal infections, is it apparent that for Florida they are not the majority of women becoming infected.

Aforementioned in this dissertation, cefixime and ceftriaxone in combination together or with azithromycin is considered the last line treatment left to combat

gonorrhea (Morgan & Decker, 2016). Including unreported treatments, the last-line-of-antibiotic-defense made up 73% of the initial treatments. These were either azithromycin and ceftriaxone in combination (35.7%) or ceftriaxone alone (37.3%). Cefixime or combinations which is also considered a last-line-of-antibiotic-defense against gonococcal infections, were less than 5% of all prescribed treatments (Figure 17).

Figure 17

Percentage of the Different Types of Last-line-of-antibiotic-defense Prescribed as Initial Treatment



Risk Factor Statewide

The risk factors elucidated some trends (Table 2). Some of the trends do not fit the current CDC recommendations for at-risk individuals. For instance, only 2.2% of the individuals acquired gonorrhea from a sex worker and only 3.5% of those who contracted gonorrhea were sex workers. Other trends were that 60.2% of the respondents had a history of STD's. A supporting trend was 32.6% stated they contracted gonorrhea through men having sex with men. Having multiple sex partners was not a determining

factor. At the time of infection 71.6% of the respondents stated they had only one partner; 13.7% had two partners; 5% had three partners; and 9.7% had four or more partners.

Table 2

Risk Factors Listed as Percentage Based on Respondents for the state of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	41.6%	58.4%
Intoxicated; Alcohol or Drug	18.6%	81.4%
Always Used Condoms	5.3%	94.7%
Sometimes Used Condoms	78.9%	21.1%
Never Used Condoms	25.7%	74.3%
Condom Use with Main Partner	11.8%	88.2%
Condom Use with Other Partner	38.8%	61.2%
Anonymous Partner	31.5%	68.5%
Meet Through the Internet	22.1%	77.9%
New Partner <90 days	29.1%	70.9%
Multiple Partners	26.3%	73.7%
Met Partner in Bar	11.3%	88.7%
Met Partner in Bath	4.0%	96.0%
Knew self-HIV status	48.8%	51.2%
Paid for Sex	2.2%	97.8%
Was Paid for Sex	3.5%	96.5%
Vaginal or Anal with Woman	27.1%	72.9%
Oral Sex with Woman	27.3%	72.7%
Unprotected Sex with Woman	27.5%	72.5%
Vaginal or Anal with Man	84.9%	15.1%
Oral Sex with Man	70.4%	29.6%
Unprotected Sex with Man	68.9%	31.1%

Men Having Sex with Men	32.6%	67.4%
Had a History of STD's	60.2%	39.8%
Has had an STD in the last 12 Months	28.0%	72.0%
Incarcerated in the Last 12 Months	7.4%	92.6%
Sexual Assault	3.6%	96.4%

There are many risk factors and key demographics that are apparent for gonococcal infections statewide. Black/African American non-Hispanic are the highest of infected. Age is another key role and the majority of infected are under the age of 30 years. Initial treatment will be an issue in relationship to drug-resistant strains. The most used medication is currently considered the last-line-of-antibiotic-defense by the CDC. Lack of condom use and having a previous STD history are also key factors. Men having sex with men is a factor but pregnancy and sex with a sex worker were not relevant.

Regional Descriptive Statistics

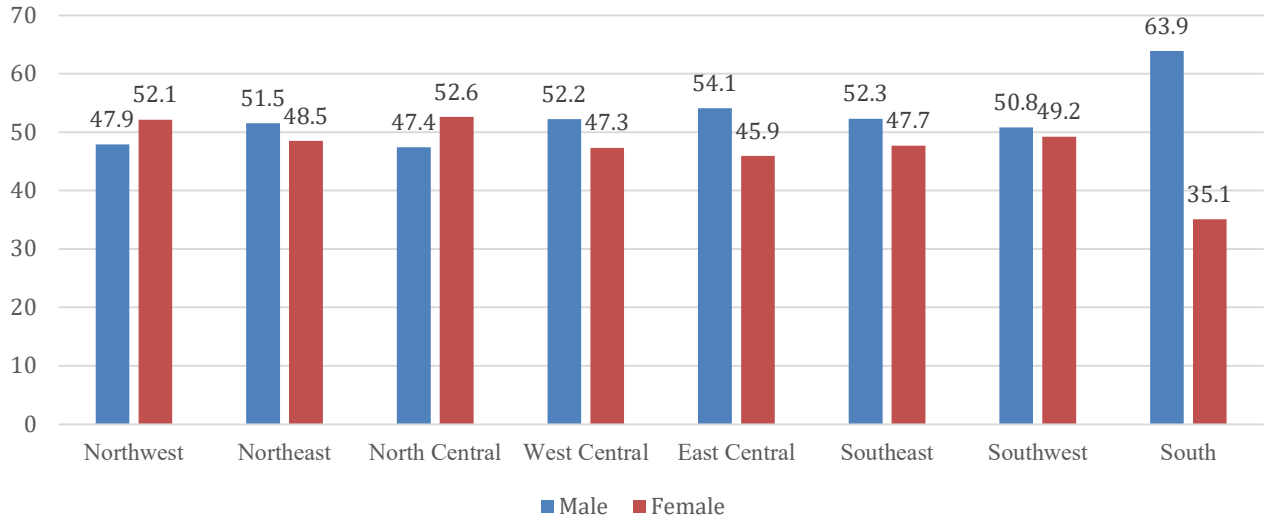
Regional Demographics and Last Line of Antibiotic Treatments

Each region has differences among and between in regard to the different demographics and the prescribe antibiotic treatments. Evaluating the different regions for gonococcal infections based on gender alone, the Northwest Region had more females (52.1%) than males (47.9%), the Northeast Region had slightly more males (51.5%) than females (48.5%), the North Central Region had slightly more females (52.6%) than males (47.4%), the West Central Region had slightly more males (52.2%) than females (47.3%), the East Central Region had slightly more males (54.1%) than females (45.9%),

the Southeast Region had slightly more males (52.3%) than females (47.7%), the Southwest Region had almost equal number of males (50.8%) and females (49.2%), and the South Region had many more males (63.9%) than females (35.1%) (Figure 18).

Figure 18

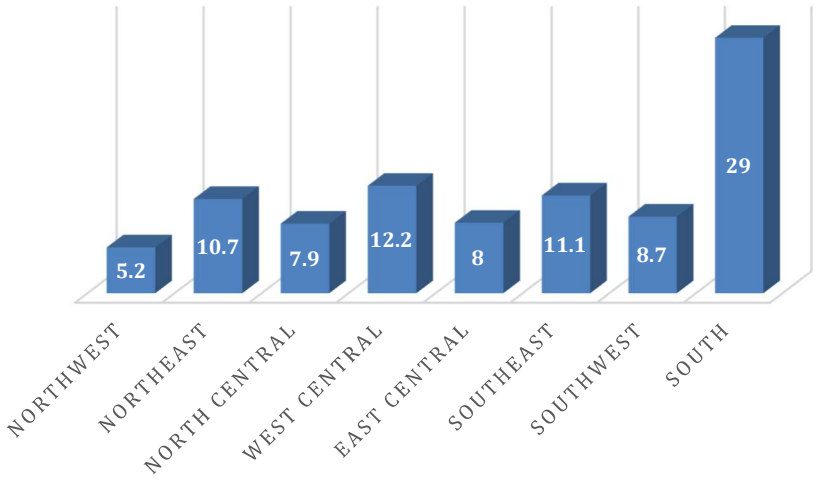
Percentage of Gonococcal Infections of Males versus Females in each Region



Men who have sex with men in general is a small percentage in some regions such as the Northwest Region at 5.2%, North Central Region at 7.9%, East Central Region at 8%, and the Southwest Region at 8.7%. Other regions were slightly higher with the Northeast Region at 10.7%, West Central Region at 12.2%, and Southeast Region at 11.1%. The highest region was the South Region making up 29% of those reporting (Figure 19).

Figure 19

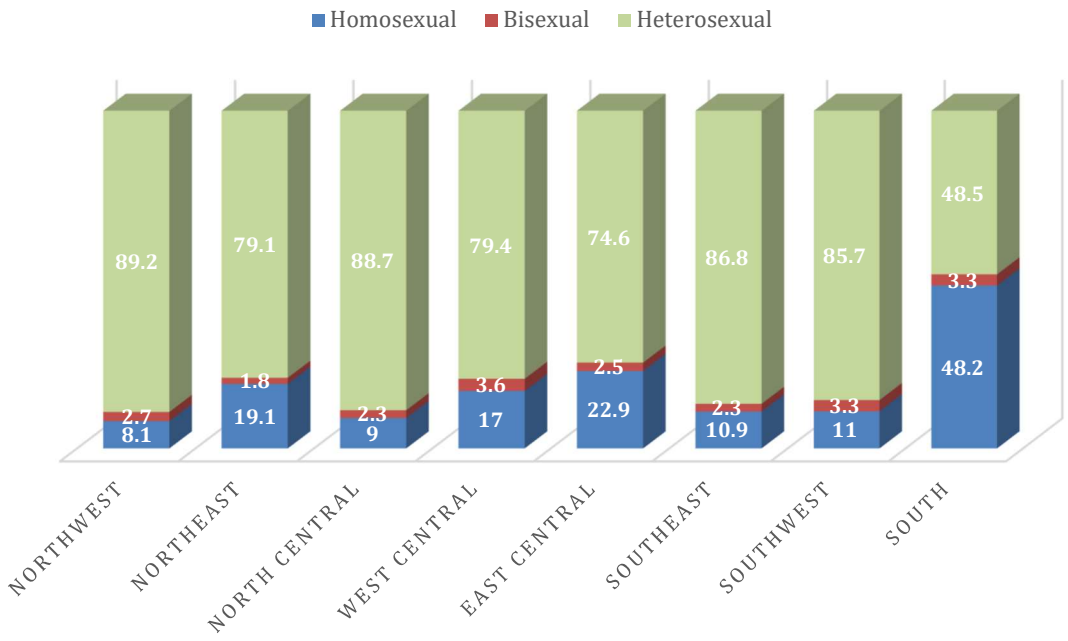
Percentage of Gonococcal Infections for Men who Have Sex with Men in each Region



Those who reported sexual orientation also varied among the regions. Of the reporting population, in the Northwest Region 8.1% self-reported as homosexual and 2.7% bisexual, the Northeast Region 19.1% self-reported as homosexual and 1.8% bisexual, the North Central Region 9.0% self-reported as homosexual and 2.3% bisexual, West Central 17.0% self-reported as homosexual and 3.6% bisexual, East Central Region 22.9% self-reported as homosexual and 2.5% bisexual, Southeast Region 10.9% self-reported as homosexual and 2.3% bisexual, Southwest Region 11.0% self-reported as homosexual and 3.3% bisexual and 2.6% bisexual, and the South Region 48.2% self-reported as homosexual and 3.3% bisexual (Figure 20).

Figure 20

Percentage of Gonococcal Infections Based on Sexual Orientation in Each Region

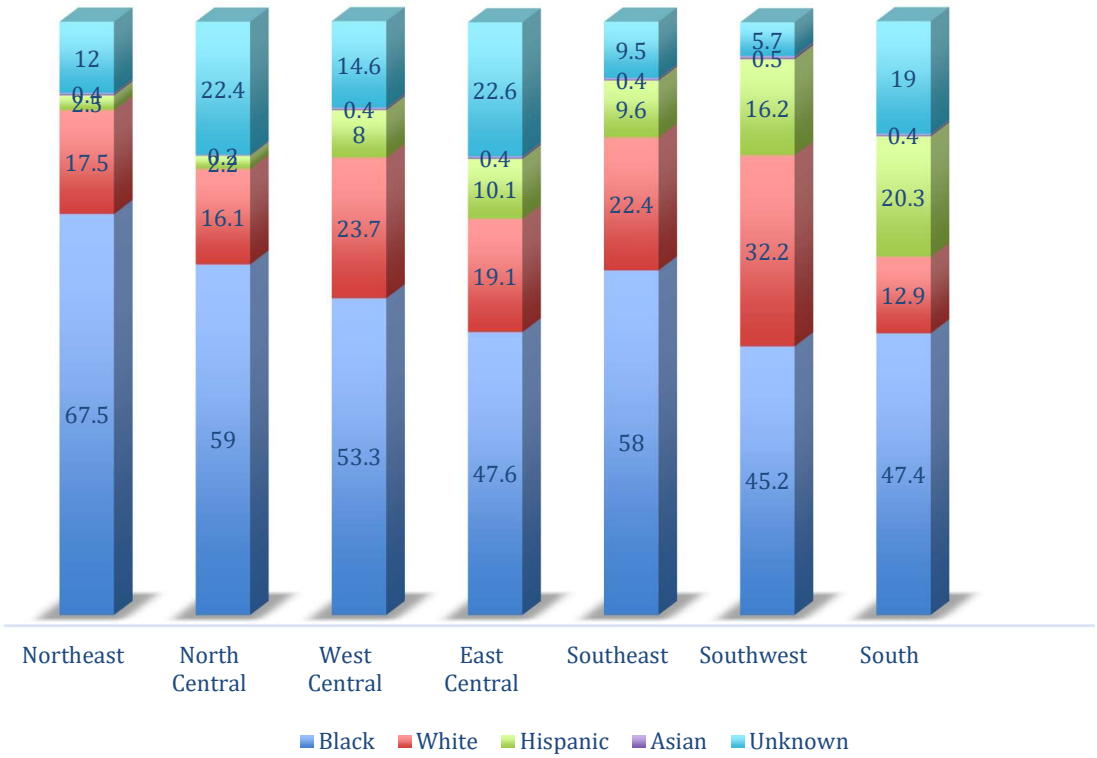


Ethnicity varies among the different regions. Within the Northwest Region Black/African American Non-Hispanic are 43.7% of the gonococcal infections followed by White Non-Hispanic (22.8%), Hispanic (1.7%), Asian Non-Hispanic (0.3%), and unknown Race/Ethnicity (31.3%) (Figure 21). In the Northeast Region Black/African American Non-Hispanic are 67.5% of the gonococcal infections followed by White Non-Hispanic (17.5%), Hispanic (2.5%), Asian Non-Hispanic (0.4%), and 12% were reported as unknown Race/Ethnicity. In the North Central Region Black/African American Non-Hispanic are 59.0% of the gonococcal infections followed by White Non-Hispanic (16.1%), Hispanic (2.2%), Asian Non-Hispanic (0.2%), and unknown Race/Ethnicity (22.4%). In the West Central Region Black/African American Non-Hispanic are 53.3% of the gonococcal infections followed by White Non-Hispanic (23.7%), Hispanic (8.0%),

Asian Non-Hispanic (0.4%), and unknown Race/Ethnicity (14.6%). In the East Central Region Black/African American Non-Hispanic are 47.6% of the gonococcal infections followed by White Non-Hispanic (19.1%), Hispanic (10.1%), Asian Non-Hispanic (0.4%), and unknown Race/Ethnicity (22.6%). In the Southeast Region Black/African American Non-Hispanic are 58.0% of the gonococcal infections followed by White Non-Hispanic (22.4%), Hispanic (9.6%), Asian Non-Hispanic (0.4%), and unknown Race/Ethnicity (9.5%). In the Southwest Region Black/African American Non-Hispanic are 45.2% of the gonococcal infections followed by White Non-Hispanic (32.2%), Hispanic (16.2%), Asian Non-Hispanic (0.5%), and unknown Race/Ethnicity (5.7%). In the South Region Black/African American Non-Hispanic are 47.4% of the gonococcal infections followed by White Non-Hispanic (12.9%), Hispanic (20.3%), Asian Non-Hispanic (0.4%) and 19.0% were reported as unknown Race/Ethnicity (Figure 21).

Figure 21

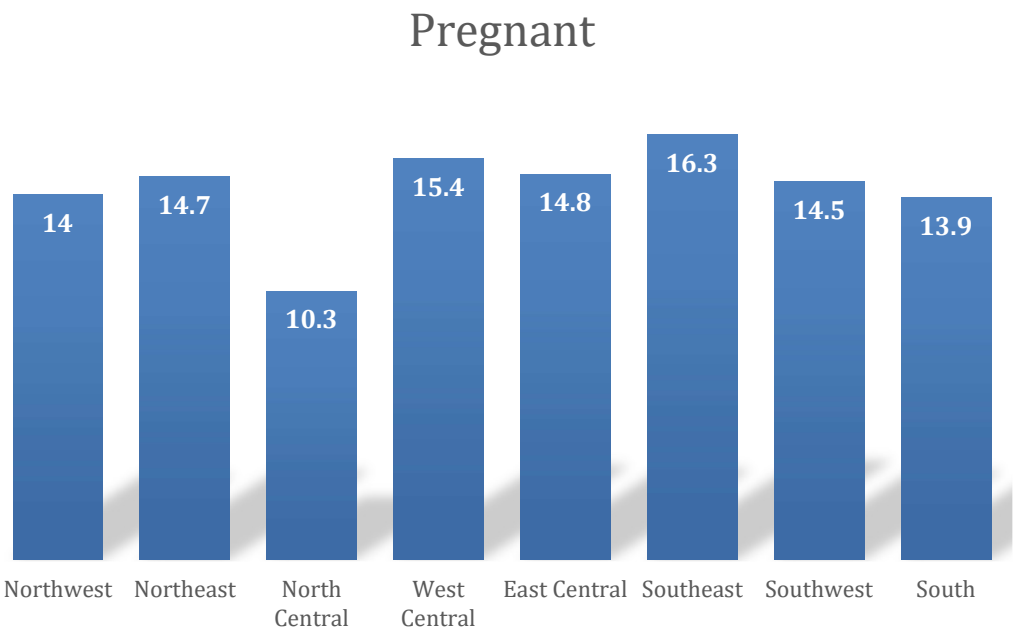
Percentage of Gonococcal Infections per Race/Ethnicity per Region



The percentage of women who reported as pregnant versus not pregnant during the time of the gonococcal infection was relatively consisted among some of the different regions. The Northwest Region was at 14%, Northeast Region at 14.7%, East Central Region at 14.8%, Southwest Region at 14.5%, and the South Region at 13.9% were in the middle and most closely related among the regions. The West Central Region at 15.4% and Southeast Region at 16.3% were the highest. The North Central Region at 10.3% was the lowest (Figure 22).

Figure 22

Percentage of Pregnant Women with Gonorrhea in Each Region

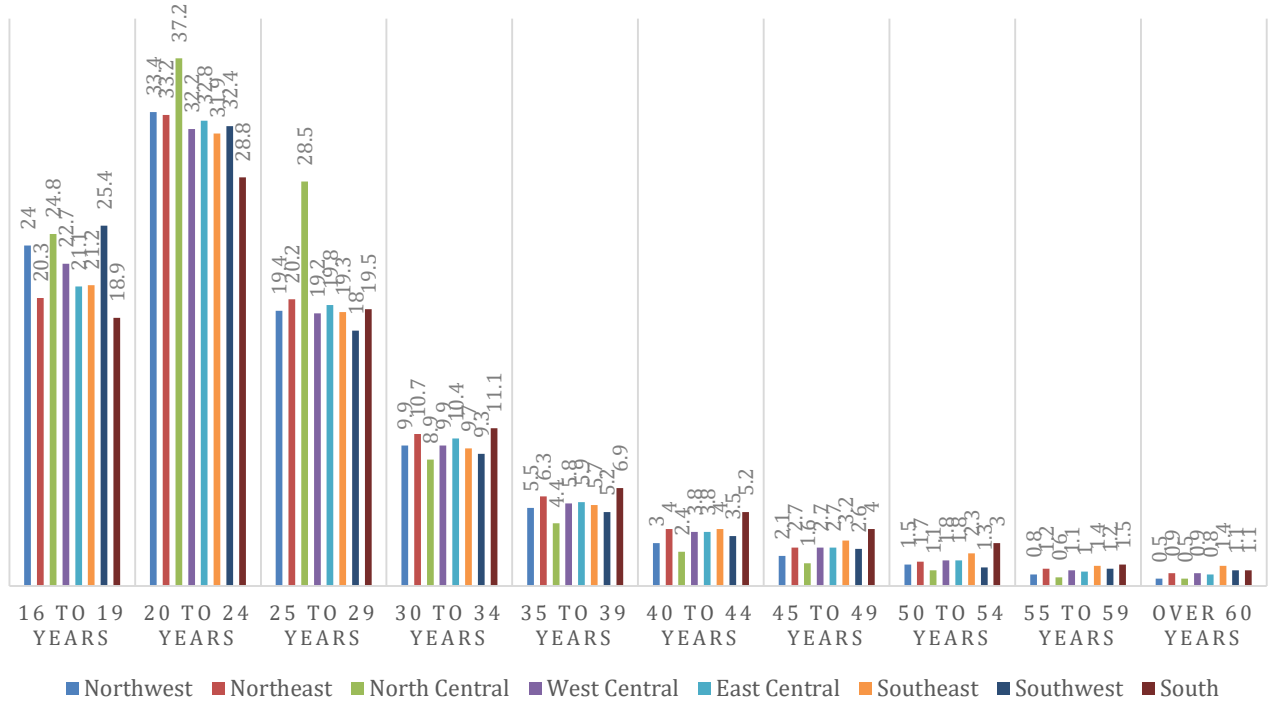


Consistently among all the regions the data indicated that young adults under the age of 30 years made up the majority of infected individuals. The data were further categorized and evaluated in 5-year age increments. In the Northwest Region ages 20 to 24 years made up 33.4% of all those infected, followed by 16 to 19 (24%), 25 to 29 (19.4%), 30 to 34 (9.9%), 35 to 39 (5.5%), 40 to 44 (3%), 45 to 49 (2.1%), 50 to 54 (1.5%), 55 to 59 (0.8%), and over 60 years (0.5%). In the Northeast Region ages 20 to 24 years made up 33.2% of all those infected, followed by 16 to 19 (20.3%), 25 to 29 (20.2%), 30 to 34 (10.7%), 35 to 39 (6.3%), 40 to 44 (4%), 45 to 49 (2.7%), 50 to 54 (1.7%), 55 to 59 (1.2%), and over 60 years (0.9%). In the North Central Region ages 20 to 24 years made up 37.2% of all those infected, followed by 16 to 19 (24.8%), 25 to 29 (28.5%), 30 to 34 (8.9%), 35 to 39 (4.4%), 40 to 44 (2.4%), 45 to 49 (1.6%), 50 to 54 (1.1%), 55 to 59

(0.6%), and over 60 years (0.5%). In the West Central Region ages 20 to 24 years made up 32.2% of all those infected, followed by 16 to 19 (22.7%), 25 to 29 (19.2%), 30 to 34 (9.9%), 35 to 39 (5.8%), 40 to 44 (3.8%), 45 to 49 (2.7%), 50 to 54 (1.8%), 55 to 59 (1.1%), and over 60 years (0.9%). In the East Central Region ages 20 to 24 years made up 32.8% of all those infected, followed by 16 to 19 (21.1%), 25 to 29 (19.8%), 30 to 34 (10.4%), 35 to 39 (5.9%), 40 to 44 (3.8%), 45 to 49 (2.7%), 50 to 54 (1.8%), 55 to 59 (1.0%), and over 60 years (0.8%). In the Southeast Region ages 20 to 24 made up 31.9% of all those infected, followed by 16 to 19 (21.2%), 25 to 29 (19.3%), 30 to 34 (9.7%), 35 to 39 (5.7%), 40 to 44 (4.0%), 45 to 49 (3.2%), 50 to 54 (2.3%), 55 to 59 (1.4%), and over 60 (1.4%). In the Southwest Region ages 20 to 24 made up 32.4% of all those infected, followed by 16 to 19 (25.4%), 25 to 29 (18.0%), 30 to 34 (9.3%), 35 to 39 (5.2%), 40 to 44 (3.5%), 45 to 49 (2.6%), 50 to 54 (1.3%), 55 to 59 (1.2%), and over 60 (1.1%). In the South Region Ages 20 to 24 made up 28.8% of all those infected, followed by 16 to 19 (18.9%), 25 to 29 (19.5%), 30 to 34 (11.1%), 35 to 39 (6.9%), 40 to 44 (5.2%), 45 to 49 (4.0%), 50 to 54 (3.0%), 55 to 59 (1.5%), and over 60 (1.1%) (Figure 23).

Figure 23

Percentage of Gonococcal Infections Per Age Group in Each Region

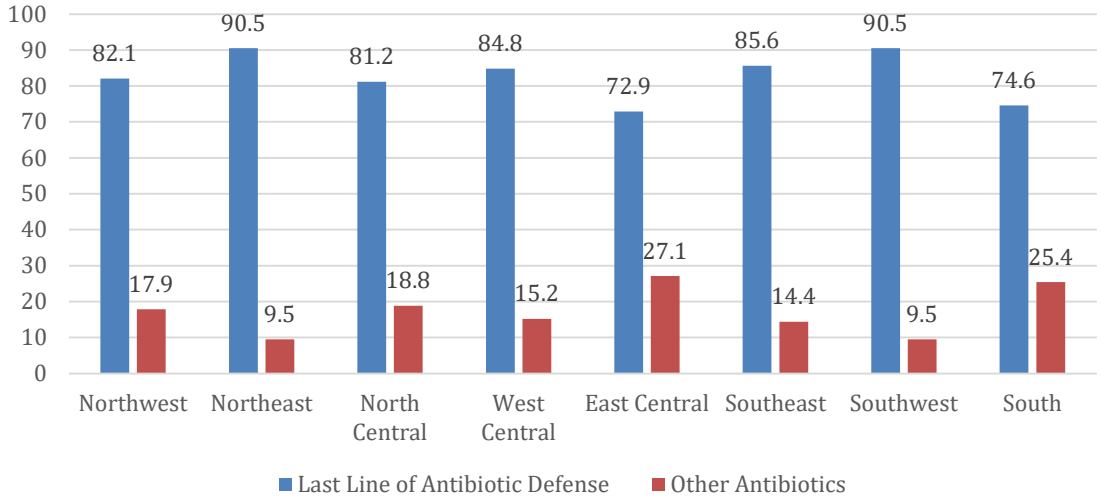


Increasing use of last line of antibiotic treatment drives drug resistance. Each region used the last line of antibiotic treatment at a relatively high rate. Including unreported treatments, the last-line-of-antibiotic-defense made up 82.1% of the initial treatments for the Northwest Region. In the Northeast Region, the last-line-of-antibiotic-defense made up 90.5% of the initial treatments. Within the North Central Region, the last-line-of-antibiotic-defense made up 81.2% of the initial treatments. In the West Central Region, the last-line-of-antibiotic-defense made up 84.8% of the initial treatments. In the East Central Region, the last-line-of-antibiotic-defense made up 72.9% of the initial treatments. Within the Southeast Region, the last-line-of-antibiotic-defense made up 85.6% of the initial treatments. In the Southwest Region, the last-line-of-

antibiotic-defense made up 90.5% of the initial treatments. Within the South Region, the last-line-of-antibiotic-defense made up 74.6% of the initial treatments (Figure 24).

Figure 24

Percentage of the Different Last-line-of-antibiotic-defense versus Other Antibiotics Prescribed as Initial Treatment in Each Region

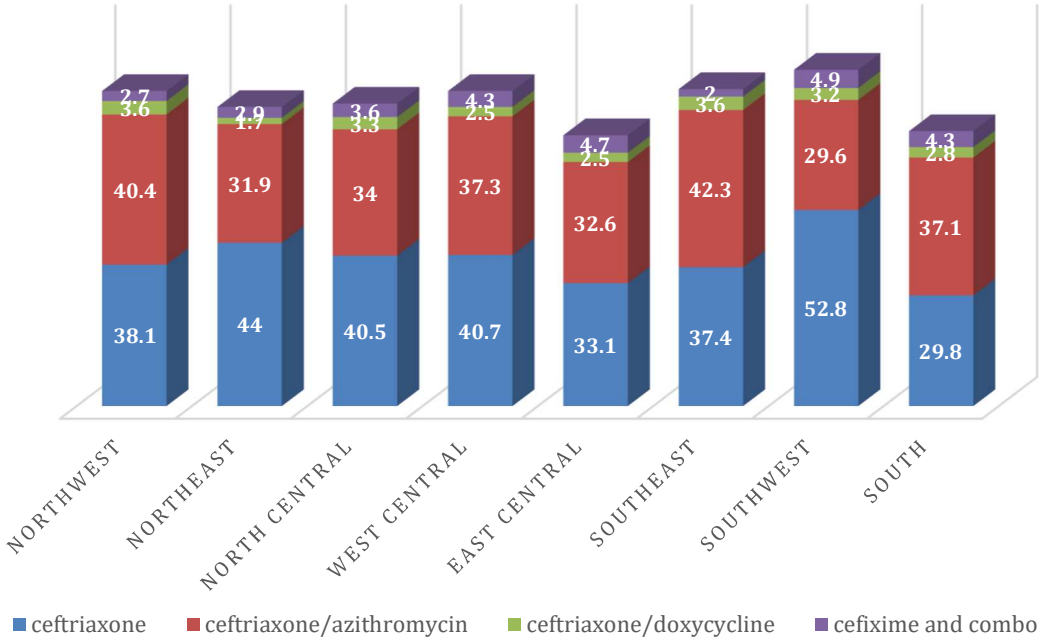


The last line of antibiotic treatments was further separated into the different last line treatments in relationship to all antibiotic treatments. These last line antibiotic treatments are azithromycin and ceftriaxone in combination, doxycycline and ceftriaxone in combination, ceftriaxone alone, and cefixime alone or in combinations. In the Northwest Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (40.4%), doxycycline and ceftriaxone in combination (3.6%), ceftriaxone alone (38.1%), or cefixime or combinations (2.7%). In the Northeast Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (31.9%), doxycycline and ceftriaxone in combination (1.7%), ceftriaxone

alone (44%), or cefixime or combinations (2.9%). In the North Central Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (34.0%), doxycycline and ceftriaxone in combination (3.3%), ceftriaxone alone (40.5%) or cefixime or combinations (3.6%). Within the West Central Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (37.3%), doxycycline and ceftriaxone in combination (2.5%), ceftriaxone alone (40.7%), or cefixime or combinations (4.3%). In the East Central Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (32.6%), doxycycline and ceftriaxone in combination (2.5%), ceftriaxone alone (33.1%), or cefixime or combinations (4.7%). In the Southeast Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (42.3%), doxycycline and ceftriaxone in combination (3.6%), ceftriaxone alone (37.4%), or cefixime or combinations (2.0%). In the Southwest Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (29.6%), doxycycline and ceftriaxone in combination (3.2%), ceftriaxone alone (52.8%), or cefixime or combinations (4.9%). Within the South Region last line antibiotic treatments were prescribed as azithromycin and ceftriaxone in combination (37.1%), doxycycline and ceftriaxone in combination (2.8%), ceftriaxone alone (29.8%), or cefixime or combinations (4.3%) (Figure 25).

Figure 25

Percentage of the Different Last Line of Antibiotics Prescribed as Initial Treatment in Each Region



Risk Factors

Northwest Region

The risk factors for the Northwest region can be found in Table 3. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. For instance, only 2.4% of the individuals acquired gonorrhea from a sex worker and only 2.2% of those who contracted gonorrhea were sex workers. Of the respondents 48.9% had a history of STD's and 11.5% stated they contracted gonorrhea through men having sex with men which does not follow the CDC recommendations for being at risk for contracting gonorrhea. Having multiple sex partners was not a determining factor. At the

time of infection 72.3% of the respondents stated they had only one partner; 16.6% had two partners; 4% had three partners; and 7.1% had four or more partners.

Table 3

Risk Factors Listed as Percentage Based on Respondents for the Northwest Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	37.5%	62.5%
Intoxicated; Alcohol or Drug	27.4%	72.6%
Always Used Condoms	8.3%	91.7%
Sometimes Used Condoms	92.7%	7.3%
Never Used Condoms	12.6%	74.3%
Condom Use with Main Partner	13.8%	86.1%
Condom Use with Other Partner	74.1%	25.8%
Anonymous Partner	27.7%	72.3%
Meet Through the Internet	12.6%	87.4%
New Partner <90 days	23.2%	76.8%
Multiple Partners	27.7%	72.3%
Met Partner in Bar	4.9%	95.1%
Met Partner in Bath	0%	100%
Knew self-HIV status	48.8%	51.2%
Paid for Sex	2.4%	97.6%
Was Paid for Sex	2.2%	97.8%
Vaginal or Anal with Woman	31.5%	68.4%
Oral Sex with Woman	38.5%	61.5%
Unprotected Sex with Woman	40.3%	59.7%
Vaginal or Anal with Man	75.2%	24.8%
Oral Sex with Man	57.3%	42.7%

Unprotected Sex with Man	62.6%	37.4%
Men Having Sex with Men	11.5%	88.5%
Had a History of STD's	48.9%	51.1%
Has had an STD in the last 12 Months	22.9%	77.1%
Incarcerated in the Last 12 Months	12.1%	87.9%
Sexual Assault	8.8%	91.2%

Note: * indicates there were not enough samples to meet Power. Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Northeast Region

The risk factors for the Northeast region can be found in Table 4. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting only 1.2% of the individuals acquired gonorrhea from a sex worker and only 2.4% of those who contracted gonorrhea were sex workers. Of the respondents, 61.1% had a history of STD's. 15.1% stated they contracted gonorrhea through men having sex with men which does not follow the CDC recommendations for at-risk. Having multiple sex partners was not a determining factor. At the time of infection 84.9% of the respondents stated they had only on partner; 9.5% had two partners; 2.9% had 3 partners; and 2.7% had 4 or more partners.

Table 4

Risk Factors Listed as Percentage Based on Respondents for the Northwest Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	9.2%	90.8%
Intoxicated; Alcohol or Drug	9.5%	90.5%

Always Used Condoms	1.5%	98.5%
Sometimes Used Condoms	67.0%	33.0%
Never Used Condoms	10.9%	89.1%
Condom Use with Main Partner	5.9%	94.1%
Condom Use with Other Partner	35.0%	67.0%
Anonymous Partner	13.8%	86.2%
Meet Through the Internet	22.1%	77.9%
New Partner <90 days	12.4%	87.6%
Multiple Partners	25.1%	84.9%
Met Partner in Bar	4.6%	95.4%
Met Partner in Bath	1.7%	98.3%
Knew self-HIV status	0%	100%
Paid for Sex	1.2%	98.8%
Was Paid for Sex	2.4%	97.6%
Vaginal or Anal with Woman	21.9%	78.1%
Oral Sex with Woman	22.2%	77.8%
Unprotected Sex with Woman	22.8%	77.2%
Vaginal or Anal with Man	80.7%	19.3%
Oral Sex with Man	68.6%	31.4%
Unprotected Sex with Man	67.6%	32.4%
Men Having Sex with Men	15.1%	84.9%
Had a History of STD's	61.1%	48.9%
Has had an STD in the last 12 Months	27.3%	72.7%
Incarcerated in the Last 12 Months	3.6%	96.4%
Sexual Assault	0.9%	99.1%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

North Central Region

The risk factors for the North Central region can be found in Table 5. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting only 0.9% of the individuals acquired gonorrhea from a sex worker and only 3.3% of those who contracted gonorrhea were sex workers. Of the reporting respondents, 60.5% had a history of STD's, 21.5% stated they contracted gonorrhea through men having sex with men although does not follow the CDC recommendations for at-risk, this is a greater percentage that in other regions. Having multiple sex partners was not a determining factor. At the time of infection 76.4% of the respondents stated they had only on partner; 15.3% had two partners; 4.1% had 3 partners; and 4.2% had 4 or more partners.

Table 5

Risk Factors Listed as Percentage Based on Respondents for the North Central Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	48.9%	51.1%
Intoxicated; Alcohol or Drug	30.0%	70.0%
Always Used Condoms	4.6%	95.6%
Sometimes Used Condoms	88%	12%
Never Used Condoms	22.2%	77.8%
Condom Use with Main Partner	13.2%	86.8%
Condom Use with Other Partner	54.4%	45.6%
Anonymous Partner	28.4%	71.6%
Meet Through the Internet	17.6%	82.4%

New Partner <90 days	23.5%	76.5%
Multiple Partners	23.6%	76.4%
Met Partner in Bar	5.6%	94.4%
Met Partner in Bath	0.5%	99.5%
Knew self-HIV status	0%	100%
Paid for Sex	0.9%	99.1%
Was Paid for Sex	3.3%	96.7%
Vaginal or Anal with Woman	29.5%	70.5%
Oral Sex with Woman	29.3%	70.7%
Unprotected Sex with Woman	34.0%	66.0%
Vaginal or Anal with Man	89.4%	10.6%
Oral Sex with Man	71.9%	28.1%
Unprotected Sex with Man	77.2%	22.8%
Men Having Sex with Men	15.1%	84.9%
Had a History of STD's	60.5%	39.5%
Has had an STD in the last 12 Months	26.6%	73.4%
Incarcerated in the Last 12 Months	10.7%	89.3%
Sexual Assault	10.7%	89.3%

Note: * indicates there were not enough samples to meet Power. Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

West Central Region

The risk factors for the West Central region can be found in Table 6. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting only 2.1% of the individuals acquired gonorrhea from a sex worker and only 4.7% of those who contracted gonorrhea were sex workers. 61.8% of the respondents had a history of STD's. 34.3% stated they contracted gonorrhea through men having sex with men which supports the CDC recommendations for at-risk. Having

multiple sex partners was not a determining factor. At the time of infection 71.4% of the respondents stated they had only on partner; 15.1% had two partners; 4.8% had 3 partners; and 8.7% had 4 or more partners.

Table 6

Risk Factors Listed as Percentage Based on Respondents for the West Central Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	40.0%	60.0%
Intoxicated; Alcohol or Drug	23.8%	76.2%
Always Used Condoms	5.2%	94.8%
Sometimes Used Condoms	77.4%	22.6%
Never Used Condoms	24.3%	75.7%
Condom Use with Main Partner	10.9%	89.1%
Condom Use with Other Partner	37.8%	62.2%
Anonymous Partner	31.9%	68.1%
Meet Through the Internet	24.4%	75.6%
New Partner <90 days	33.5%	66.5%
Multiple Partners	28.6%	71.4%
Met Partner in Bar	12.6%	87.4%
Met Partner in Bath	3.6%	96.4%
Knew self-HIV status	0%	100%
Paid for Sex	2.1%	97.9%
Was Paid for Sex	4.7%	95.3%
Vaginal or Anal with Woman	33.7%	66.3%
Oral Sex with Woman	29.5%	70.3%
Unprotected Sex with Woman	31.0%	69.0%
Vaginal or Anal with Man	91.5%	8.5%

Oral Sex with Man	70.1%	29.9%
Unprotected Sex with Man	71.3%	28.7%
Men Having Sex with Men	34.3%	65.7%
Had a History of STD's	61.8%	38.2%
Has had an STD in the last 12 Months	28.3%	71.7%
Incarcerated in the Last 12 Months	12.5%	87.5%
Sexual Assault	5.1%	94.9%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

East Central Region

The risk factors for the East Central region can be found in Table 7. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting only 3.6% of the individuals acquired gonorrhea from a sex worker and only 3.6% of those who contracted gonorrhea were sex workers. Those who had a history of an STD made up 57.9% of the respondents. In addition, 29.3% stated they contracted gonorrhea through men having sex with men which supports the CDC recommendations for at-risk. Having multiple sex partners was not a determining factor. At the time of infection 76.6% of the respondents stated they had only on partner; 12% had two partners; 3.9% had 3 partners; and 7.5% had 4 or more partners.

Table 7

Risk Factors Listed as Percentage Based on Respondents for the East Central Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	58.9%	41.1%

Intoxicated; Alcohol or Drug	22.0%	78.0%
Always Used Condoms	3.5%	96.5%
Sometimes Used Condoms	71.6%	28.4%
Never Used Condoms	20.8%	79.2%
Condom Use with Main Partner	8.7%	91.3%
Condom Use with Other Partner	40.9%	59.1%
Anonymous Partner	28.9%	71.1%
Meet Through the Internet	21.1%	78.9%
New Partner <90 days	21.4%	78.6%
Multiple Partners	23.4%	76.6%
Met Partner in Bar	7.1%	92.9%
Met Partner in Bath	1.2%	98.8%
Knew self-HIV status	0%	100%
Paid for Sex	3.6%	96.4%
Was Paid for Sex	3.6%	96.4%
Vaginal or Anal with Woman	28.1%	71.9%
Oral Sex with Woman	30.9%	69.1%
Unprotected Sex with Woman	31.6%	68.4%
Vaginal or Anal with Man	87.7%	12.3%
Oral Sex with Man	73.7%	26.3%
Unprotected Sex with Man	74.8%	25.2%
Men Having Sex with Men	29.3%	70.7%
Had a History of STD's	57.9%	42.1%
Has had an STD in the last 12 Months	30.3%	69.7%
Incarcerated in the Last 12 Months	7.7%	92.3%
Sexual Assault	3.4%	96.6%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Southeast Region

The risk factors for the Southeast region can be found in Table 8. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting 8.47% of the individuals acquired gonorrhea from a sex worker which is much higher than in other regions. Only 3.4% of those who contracted gonorrhea were sex workers. Of those reporting, 49.2% of the respondents had a history of STD's which lower in other regions as well as comparing to Statewide. Only 17.6% stated they contracted gonorrhea through men having sex with men which does not support the CDC recommendations for at-risk. Having multiple sex partners was not a determining factor. At the time of infection 79.9% of the respondents stated they had only on partner; 12.6% had two partners; 2.6% had 3 partners; and 4.9% had 4 or more partners.

Table 8

Risk Factors Listed as Percentage Based on Respondents for the Southeast Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	52.2%	47.8%
Intoxicated; Alcohol or Drug	17.6%	82.4%
Always Used Condoms	6.9%	93.1%
Sometimes Used Condoms	77.5%	22.5%
Never Used Condoms	52.0%	48.0%
Condom Use with Main Partner	9.6%	90.4%
Condom Use with Other Partner	19.7%	80.3%
Anonymous Partner	31.8%	68.2%
Meet Through the Internet	19.8%	80.2%

New Partner <90 days	27.9%	72.1%
Multiple Partners	20.1%	79.9%
Met Partner in Bar	7.4%	92.6%
Met Partner in Bath	0.6%	99.4%
Knew self-HIV status	0%	100%
Paid for Sex	8.5%	91.5%
Was Paid for Sex	3.4%	96.4%
Vaginal or Anal with Woman	37.3%	62.7%
Oral Sex with Woman	32.2%	67.8%
Unprotected Sex with Woman	35.8%	64.2%
Vaginal or Anal with Man	81.2%	18.8%
Oral Sex with Man	63.9%	36.1%
Unprotected Sex with Man	64.9%	35.1%
Men Having Sex with Men	17.6%	82.4%
Had a History of STD's	49.2%	50.8%
Has had an STD in the last 12 Months	18.7%	81.3%
Incarcerated in the Last 12 Months	8.5%	91.5%
Sexual Assault	4.6%	95.4%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Southwest Region

The risk factors for the Southwest region can be found in Table 9. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting 2.5% of the individuals acquired gonorrhea from a sex worker which is much higher than in other regions. Only 2.8% of those who contracted gonorrhea were sex workers. Lower than other regions as well as comparing to Statewide, 52.5% of the respondents had a history of STD's. Interesting, 22.6% stated they contracted gonorrhea

through men having sex with men which slightly supports the CDC recommendations for at-risk. Having multiple sex partners was not a determining factor. At the time of infection 80.8% of the respondents stated they had only on partner; 11.8% had two partners; 3.7% had 3 partners; and 3.7% had 4 or more partners.

Table 9

Risk Factors Listed as Percentage Based on Respondents for the Southwest Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	49.5%	50.5%
Intoxicated; Alcohol or Drug	27.8%	72.2%
Always Used Condoms	7.8%	92.2%
Sometimes Used Condoms	87.1%	12.9%
Never Used Condoms	38.1%	61.9%
Condom Use with Main Partner	14.7%	85.3%
Condom Use with Other Partner	51.3%	48.7%
Anonymous Partner	9.6%	90.4%
Meet Through the Internet	19.8%	80.2%
New Partner <90 days	25.1%	74.9%
Multiple Partners	23.2%	76.8%
Met Partner in Bar	6.7%	93.3%
Met Partner in Bath	0.6%	99.4%
Knew self-HIV status	0%	100%
Paid for Sex	2.5%	97.5
Was Paid for Sex	2.8%	97.2%
Vaginal or Anal with Woman	32.8%	67.2%
Oral Sex with Woman	32.5%	67.5%
Unprotected Sex with Woman	35.2%	64.8%

Vaginal or Anal with Man	83.4%	16.6%
Oral Sex with Man	61.8%	38.2%
Unprotected Sex with Man	75.1%	24.9%
Men Having Sex with Men	12.0%	88.0%
Had a History of STD's	52.5%	47.5%
Has had an STD in the last 12 Months	24.2%	75.8%
Incarcerated in the Last 12 Months	11.0%	89.0%
Sexual Assault	8.0%	92.0%

Note: * indicates there were not enough samples to meet Power. Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

South Region

The risk factors for the South region can be found in Table 10. The risk factors in this region do not fit the current CDC recommendations for at-risk individuals. Of the reporting 2.0% of the individuals acquired gonorrhea from a sex worker which is much higher than in other regions. Only 4.0% of those who contracted gonorrhea were sex workers. Higher than other regions and the State, 66.7% of the respondents had a history of STD's. Supporting the CDC recommendations for at-risk groups, 55.3% stated they contracted gonorrhea through men having sex with men. At the time of infection 55.9% of the respondents stated they had only on partner; 15.5% had two partners; 7.9% had 3 partners; and 20.7% had 4 or more partners.

Table 10

Risk Factors Listed as Percentage Based on Respondents for the South Region of Florida

Risk Factor	Percentage Yes	Percentage No
Drug Use	49.8%	50.2%

Intoxicated; Alcohol or Drug	15.0%	85%
Always Used Condoms	7.5%	92.5%
Sometimes Used Condoms	69.0%	11.0%
Never Used Condoms	16.8%	83.2%
Condom Use with Main Partner	17.3%	82.7%
Condom Use with Other Partner	38.2%	61.8%
Anonymous Partner	44.6%	55.4%
Meet Through the Internet	32.9%	67.1%
New Partner <90 days	42.6%	57.4%
Multiple Partners	28.5%	71.5%
Met Partner in Bar	19.3%	80.7%
Met Partner in Bath	8.3%	91.7%
Knew self-HIV status	0%	100%
Paid for Sex	2.0%	98.0%
Was Paid for Sex	4.0%	96.0%
Vaginal or Anal with Woman	19.4%	80.6%
Oral Sex with Woman	21.2%	78.8%
Unprotected Sex with Woman	17.2%	82.8%
Vaginal or Anal with Man	86.4%	13.6%
Oral Sex with Man	77.3%	22.7%
Unprotected Sex with Man	65.3%	34.7%
Men Having Sex with Men	55.3%	44.7%
Had a History of STD's	66.7%	33.3%
Has had an STD in the last 12 Months	33.1%	66.9%
Incarcerated in the Last 12 Months	4.6%	95.4%
Sexual Assault	2.0%	98.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Study Results for Research Question 1

Research Question 1: Are there differences in using last-line-of-antibiotic-defense between Florida as a whole and each of the eight regions?

Hypothesis 1

H_0: There is no statistical significance between each of the eight different regions and Florida as a whole for the last-line-of-antibiotic-defense associated with gonococcal infections.

H_a: There is a statistical significance between each of the eight different regions and Florida as a whole for the last-line-of-antibiotic-defense associated with gonococcal infections.

Findings

Based on the findings the null hypothesis can be rejected when applied to the Northwest, Northeast, North Central, East Central, West Central, Southeast, and South regions but must be accepted for the Southwest region. The results supporting these findings are as follows.

Chi-square and cross tabulations were conducted to compare the last-line-of-antibiotic-defense between Florida as a whole and the eight different regions. There is a statistically significant association between Florida and the Northwest Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 16946) = 14.652, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northwest region (68.2%) versus Florida (84.8%) (Table A1 Appendix A). There is a statistically significant association between Florida and the North Central Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 29245) = 28.914, $p <$

0.05. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the North Central Region (69.3%) versus Florida (81.7%) (Table A2 Appendix A). There is a statistically significant association between Florida and the Northeast Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 33564) = 28.796, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northeast Region (70.0%) versus Florida (80.4%) (Table A3 Appendix A). There is a statistically significant association between Florida and the West Central Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 64192) = 56.274, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the West Central Region (69.5%) versus Florida (84.4%) (Table A4 Appendix A). There is a statistically significant association between Florida and the East Central Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 48836) = 61.793, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the East Central Region (69.8%) versus Florida (73.6%) (Table A5 Appendix A). There is not a statistically significant association between Florida and the Southwest Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 48836) = 61.793, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest region (70%) versus Florida (90.2%) (Table A6 Appendix A). There is a statistically significant association between Florida and the Southeast Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 18037) = 54.963, $p < 0.05$. The results of the cross

tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (68.2%) versus Florida (84.6%) (Table A7 Appendix A). There is a statistically significant association between Florida and the South Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 64110) = 103.973, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the South Region (69.6%) versus Florida (73.7%) (Table A8 Appendix A).

Study Results for Research Question 2

Research Question 2: Are there differences in using last-line-of-antibiotic-defense among the eight Florida regions?

Hypothesis 2:

H_0: There is no statistical significance between the eight Florida regions in regard to the last-line-of-antibiotic-defense for gonococcal infections.

H_a: There is a statistical significance between the eight Florida regions in regard to the last-line-of-antibiotic-defense for gonococcal infections.

Findings

Based on the findings the null hypothesis can be rejected. The results supporting the findings are the following. Chi-square and a cross tabulations were conducted to compare the last-line-of-antibiotic-defense between the eight different regions.

Northwest Region

There is a statistically significant association between the Northwest Region and the North Central Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 16945) = 36.322, $p < 0.05$. The results of the cross tabulation indicate that the last-line-

of-antibiotic-defense was prescribed at a lower rate for the Northwest Region (84.4%) versus the North Central Region (85.4%). There is not a statistically significant association between the Northwest Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 16946) = 6.601, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northwest Region (78.8%) versus the Northeast Region (84.9%). There is a statistically significant association between the Northwest Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16946) = 12.021, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northwest Region (80.6%) versus the West Central Region (85%). There is a statistically significant association between the Northwest Region and the East Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16944) = 10.894, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Northwest Region (84.4%) versus the East Central Region (69.5%). There is a statistically significant association between the Northwest Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 10.768, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Northwest Region (73.6%) versus the Southwest Region (69.8%). There is a statistically significant association between the Northwest Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16946) = 13.113, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense

was prescribed at a higher rate for the Northwest Region (85%) versus the Southeast Region (84.7%). There is not a statistically significant association between the Northwest Region and the South Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16946) = 3.950, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northwest Region (80.2%) versus the South Region (84.9%).

Northeast Region

There is a statistically significant association between the Northeast Region and the North Central Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 29244) = 30.497, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Northeast Region (81.6%) versus the North Central Region (80.1%). There is not a statistically significant association between the Northeast Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 16946) = 6.601, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northeast Region (78.8%) versus the Northwest Region (84.9%). There is a statistically significant association between the Northeast Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 33567) = 104.433, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Northeast Region (81.6%) versus the West Central Region (80.9%). There is a statistically significant association between the Northeast Region and the East Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4,

N = 33564) = 18.613, p < 0.05. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northeast Region (71.3%) versus the East Central Region (80.2%). There is not a statistically significant association between the Northeast Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: χ2 (4, N = 8409) = 8.017, p > 0.05. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Northeast Region (90%) versus the Southwest Region (73.4%). There is a statistically significant association between the Northeast Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: χ2 (4, N = 18037) = 30.101, p < 0.05. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Northeast Region (85.9%) versus the Southeast Region (78.4%). There is a statistically significant association between the Northeast Region and the South Region in regard to the last-line-of-antibiotic-defense: χ2 (4, N = 33565) = 17.710, p < 0.05. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Northeast Region (79.3%) versus the South Region (80.3%).

North Central Region

There is a statistically significant association between the North Central Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 16945) = 36.322, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the North Central Region (85.4%) versus the Northwest Region (84.4%). There is a statistically significant

association between the North Central Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: χ^2 (4, N = 29244) = 30.497, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the North Central Region (80.1%) versus the Northeast Region (81.6%). There is a statistically significant association between the North Central Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 29245) = 10.644, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the North Central Region (81.6%) versus the West Central Region (81.1%). There is a statistically significant association between the North Central Region and the East Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N =29242) = 23.896, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the North Central Region (74.5%) versus the East Central Region (81.2%). There is not a statistically significant association between the North Central Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8408) = 1.672, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the North Central Region (90.5%) versus the Southwest Region (80.5%). There is a statistically significant association between the North Central Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18036) = 12.749, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the North Central Region (90.5%) versus the Southeast Region (80.5%). There is a statistically

significant association between the North Central Region and the South Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 29243) = 13.432, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the North Central Region (80.1%) versus the South Region (81.1%).

West Central Region

There is a statistically significant association between the West Central Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16946) = 12.021, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the West Central Region (85%) versus Northwest Region (80.6%) the. There is a statistically significant association between the West Central Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 33567) = 104.433, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the West Central Region (80.9%) versus the Northeast Region (81.6%). There is a statistically significant association between the West Central Region and the North Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 29245) = 10.644, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the West Central Region (81.1%) versus the North Central Region (81.6%). There is a statistically significant association between the West Central Region and the East Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 48839) = 20.258, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate

for the West Central Region (72.6%) versus the East Central Region (83.1%). There is not a statistically significant association between the West Central Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 8.838, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the West Central Region (90.3%) versus the Southwest Region (78.7%). There is a statistically significant association between the West Central Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18037) = 25.723, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the West Central Region (85.5%) versus the Southeast Region (79%). There is a statistically significant association between the West Central Region and the South Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 64113) = 33.992, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the West Central Region (73.9%) versus the South Region (84.7%).

East Central Region

There is a statistically significant association between the East Central Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16944) = 10.894, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the East Central Region (69.5%) versus the Northwest Region (84.4%). There is a statistically significant association between the East Central Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 33564) = 18.613, $p < 0.05$. The results of the cross

tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the East Central Region (80.2%) versus the Northeast Region (71.3%). There is a statistically significant association between the East Central Region and the North Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N =29242) = 23.896, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the East Central Region (81.2%) versus the North Central Region (74.5%). There is a statistically significant association between the East Central Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 48839) = 20.258, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the East Central Region (83.1%) versus the West Central Region (72.6%). There is a statistically significant association between the East Central Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8407) = 9.747, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the East Central Region (90.5%) versus the Southwest Region (80.5%). There is a statistically significant association between the East Central Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18037) = 25.723, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the East Central Region (85.4%) versus the Southeast Region (76.2%). There is not a statistically significant association between the East Central Region and the South Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 48838) = 5.146, $p > 0.05$. The results of the cross tabulation

indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the East Central Region (90.5%) versus the South Region (80.5%).

Southwest Region

There is a statistically significant association between the Southwest Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 10.768, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (69.8%) versus the Northwest Region (73.6%). There is not a statistically significant association between the Southwest Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 8.017, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (73.4%) versus Northeast Region (90%) the. There is not a statistically significant association between the Southwest Region and the North Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8408) = 1.672, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (80.5%) versus the North Central Region (90.5%). There is not a statistically significant association between the Southwest Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 8.838, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Southwest Region (78.7%) versus the West Central Region (90.3%). There is a statistically significant association between the Southwest Region and the East Central Region in regard to the last-line-of-

antibiotic-defense: $\chi 2$ (4, N = 8407) = 9.747, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (80.5%) versus the East Central Region (90.5%). There is a statistically significant association between the Southwest Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 13.287, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (85.3%) versus the Southeast Region (90.5%). There is not a statistically significant association between the Southwest Region and the South Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 4.268 $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southwest Region (76.5%) versus the South Region (90.3%).

Southeast Region

There is a statistically significant association between the Southeast Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16946) = 13.113, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southeast Region (84.7%) versus the Northwest Region (85%). There is a statistically significant association between the Southeast Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18037) = 30.101, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southeast Region (78.4%) versus the Northeast Region (85.9%). There is a statistically significant

association between the Southeast Region and the North Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18036) = 12.749, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southeast Region (80.5%) versus the North Central Region (90.5%). There is a statistically significant association between the Southeast Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18037) = 25.723, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southeast Region (79%) versus the West Central Region (85.5%). There is a statistically significant association between the Southeast Region and the East Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 18037) = 25.723, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southeast Region (76.2%) versus the East Central Region (85.4%). There is a statistically significant association between the Southeast Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 13.287, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the Southeast Region (90.5%) versus the Southwest Region (85.3%). There is a statistically significant association between the Southeast Region and the South Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16037) = 17.020, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a lower rate for the Southeast Region (79.7%) versus the South Region (85.2%).

South Region

There is not a statistically significant association between the South Region and the Northwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16946) = 3.950, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the South Region (84.9%) versus the Northwest Region (80.2%). There is a statistically significant association between the South Region and the Northeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 33565) = 17.710, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the South Region (80.3%) versus the Northeast Region (79.3%). There is a statistically significant association between the South Region and the North Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 29243) = 13.432, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the South Region (81.1%) versus the North Central Region (80.1%). There is a statistically significant association between the South Region and the West Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 64113) = 33.992, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the South Region (84.7%) versus the West Central Region (73.9%).

There is not a statistically significant association between the South Region and the East Central Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 48838) = 5.146, $p > 0.05$. The results of the cross tabulation indicate that the last-line-of-

antibiotic-defense was prescribed at a lower rate for the South Region (80.5%) versus the East Central Region (90.5%). There is not a statistically significant association between the South Region and the Southwest Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 8409) = 4.268 $p > 0.05$. There is a statistically significant association between the South Region and the Southeast Region in regard to the last-line-of-antibiotic-defense: $\chi 2$ (4, N = 16037) = 17.020, $p < 0.05$. The results of the cross tabulation indicate that the last-line-of-antibiotic-defense was prescribed at a higher rate for the South Region (85.2%) versus the Southeast Region (79.7%).

Study Results for Research Question 3

Research Question 3: What are the statistically significant factors associated with being treated with last-line-of-antibiotic-defense in each of the eight regions and the state of Florida?

Hypothesis 3:

H_0: There are no statistically significant factors associated with being treated with last-line-of-antibiotic-defense in the eight regions.

H_a: There are statistically significant factors associated with being treated with last-line-of-antibiotic-defense in the eight regions.

Findings

There is statistical significance between the initial treatment and statistically significant risk factors and demographics per region. Based on these findings the null hypothesis can be rejected. The results supporting these findings area as follows. Multiple logistic regression models were conducted for each of the eight regions and Florida as a

whole. Race/ethnic populations, age range, gender, men who have sex with men, sexual orientation, and pregnancy in relationship to the prescribed last-line-of-antibiotic-defense were compared. There are 27 identified significant risk factors that were also compared to the last-line-of-antibiotic-defense.

State of Florida

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are race/ethnicity, age range, gender, pregnancy, always use condoms, HIV self-aware, oral sex with female, unprotected anal or vaginal sex with a male, history of a prior STD, and had an STD in the last 12 months from the time of the infection (Table B1 Appendix B). The multiple logistic regression for Florida there are ten statistically significant variables. Of those ten statistically significant variables three have an increased likelihood of being prescribed the last-line-of-antibiotic-defense. This then indicates that these particular variables could be indicative of the probability of developing drug resistance for gonococcal infections. These variables are age range which has a 3.4% increase likelihood of being prescribed the last-line-of-antibiotic-defense, oral sex with a female has a 22.1% greater likelihood of receiving the last-line-of-antibiotic-defense, and sex with a male has a 16.6% greater likelihood of being prescribed the last-line-of-antibiotic-defense. Race/ethnicity, gender, pregnancy, always using condoms, knowing your HIV status, history of a prior STD, history of a prior STD within 90 days, and gender may all be protective factors Since these are less likely to be prescribed the last-line-of-antibiotic-defense. It appears that gender would be the greatest protective factor. Within gender alone as an internal

comparison an odds ratio was conducted for males versus females (female versus male, OR = 0.756 (95% CI: 0.742, 0.770). Females have a less likelihood of being prescribed the last-line-of-antibiotic-defense versus males (OR = 0.944 (95% CI: 0.941, 0.948)) and males have a 5.96% greater likelihood of being prescribed the last-line-of-antibiotic-defense.

Northwest Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are age range, men who have sex with men, sexual orientation, pregnancy, sometimes use condoms, never use condoms, HIV self-aware, oral sex with female, unprotected anal or vaginal sex with a male, and had history of a prior STD (Table B2 Appendix B). In the Northwest Region there are eight statistically significant risk factors based on the multiple logistic regression. Of the eight variables four variables have an increased likelihood of being prescribed the last-line-of-antibiotic-defense. Age groups have only a 2.3% increase likelihood of being prescribed the last-line-of-antibiotic-defense. If a person had a history of a prior STD have a 25.1% chance increased likelihood of being prescribed the last-line-of-antibiotic-defense. Those who only use condoms sometimes have a 135.6% increased chance of being prescribed the last-line-of-antibiotic-defense. Those who never use condoms have a 137.2% increase chance of being prescribed the last-line-of-antibiotic-defense. This then indicates that these particular variables could be indicative of the probability of developing drug resistance for gonococcal infections. The remaining variables such as knowing HIV status, pregnancy, sexual orientation, and men who have

sex with men are more likely to be protective factors, with men who have sex with men being the greatest protective factor.

Northeast Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are age range, gender, sexual orientation, pregnancy, sometimes use condoms, new partner within 90 days at the time of the infection, number of sex partners, HIV self-aware, oral sex with female, and incarcerated within the last 12 months from the time of infection (Table B3 Appendix B). The multiple logistic regression for the Northeast Region indicates that there are ten statistically significant risk factors. There are three risk factors that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Age range has a 6.2% increased risk of being prescribed the last-line-of-antibiotic-defense. The number of sex partners have a 14% increase of being prescribed the last-line-of-antibiotic-defense. Having oral sex with a female is a 149.4% increase chance of being prescribed the last-line-of-antibiotic-defense. There are seven factors that may have a protective effect these are gender, sexual orientation, pregnancy, sometimes using condoms, new partner within 90 days, knowing HIV status, and incarcerated within the last 12 months. Of these factors gender has the greatest protective effect. Within gender alone as an internal comparison, an odds ratio was conducted for males versus females (female versus male, OR = 0.616 (95% CI: 0.584, 0.651). Females have a less likelihood of being prescribed the last-line-of-antibiotic-defense versus males (OR = 0.911 (95% CI: 0.901, 0.920)) and males have a 9.79% greater likelihood of being prescribed the last-line-of-antibiotic-defense.

North Central Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are race/ethnicity, gender, men who have sex with men, sexual orientation, pregnancy, condom use with other partners, HIV self-aware, and oral sex with male (Table B4 Appendix B). The multiple logistic regression for the North Central Region indicates that there are nine statistically significant risk factors. There is only one risk factor that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Those who used condoms with their other partner had a 99.3% increased risk of being prescribed the last-line-of-antibiotic-defense. There are eight factors that may have a protective effect these are race/ethnics, gender, men who have sex with men, sexual orientation, pregnancy, knowing HIV status, and oral sex with a male. Of these factors, pregnancy has the greatest protective effect.

West Central Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are race/ethnicity, age range, gender, men who have sex with men, sexual orientation, pregnancy, condom use with other partners, HIV self-aware, and vaginal or anal sex with a female (Table B5 Appendix B). The multiple logistic regression for the West Central Region indicates that there are eight statistically significant risk factors. There is only one risk factor that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Age range had a 4.0% increased risk of being prescribed the last-line-of-antibiotic-defense. There are

seven factors that may have a protective effect, and these are race/ethnics, gender, men who have sex with men, sexual orientation, pregnancy, knowing HIV status, and vaginal or anal sex with a female. Of these factors, pregnancy has the greatest protective effect.

East Central Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are race/ethnicity, age range, gender, pregnancy, drug use, always use condoms, HIV self-aware, and victim of sexual assault (Table B6 Appendix B). The multiple logistic regression for the East Central Region indicates that there are eight statistically significant risk factors. There are two risk factors that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Age range had a 4.7% increased risk of being prescribed the last-line-of-antibiotic-defense. Condom use always had a 77.6% increased risk of being prescribed the last-line-of-antibiotic-defense. There are six factors that may have a protective effect, and these are race/ethnics, gender, pregnancy, drug use, knowing HIV status, and victim of sexual assault. Of these factors, pregnancy has the greatest protective effect.

Southeast Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are age range, men who have sex with men, sexual orientation, pregnancy, HIV self-aware, was paid for sex, vaginal or anal sex with a man, incarcerated within the last 12 months from the time of infection, and victim of sexual assault (Table B7 Appendix B). The multiple logistic regression for the Southeast Region indicates that there are nine statistically significant

risk factors. There two risk factors that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Age range had an 8.1% increased risk of being prescribed the last-line-of-antibiotic-defense. Those who were incarcerated within the last 12 months of the time of the infection had a 29.3% increased risk of being prescribed the last-line-of-antibiotic-defense. There are seven factors that may have a protective effect, and these are men who have sex with men, sexual orientation, pregnancy, knowing HIV status, was paid for sex, vaginal or anal sex with a male, and victim of sexual assault. Of these factors, victim of sexual assault has the greatest protective effect.

Southwest Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are age range, sexual orientation, pregnancy, oral sex with a female, and a history of a prior STD (Table B8 Appendix B). The multiple logistic regression for the Southwest Region indicates that there are five statistically significant risk factors. There are two risk factors that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Age range had an 4.9% increased risk of being prescribed the last-line-of-antibiotic-defense. Those who had oral sex with a female had a 141.2% increased risk of being prescribed the last-line-of-antibiotic-defense. There are three factors that may have a protective effect, and these are sexual orientation, pregnancy, and those who had a history of a prior STD within the last 12 months from the time of the infection. Of these factors, pregnancy has the greatest protective effect.

South Region

The results of the multiple logistic regression indicate that some of the demographics and risk factors are statistically significant. These are race/ethnicity, age range, gender, men who have sex with men, sexual orientation, pregnancy, HIV self-aware, and was paid for sex (Table B9 Appendix B). The multiple logistic regression for the South Region indicates that there are eight statistically significant risk factors. There are three risk factors that are at an increased risk of being prescribed the last-line-of-antibiotic-defense. Age range had an 5% increased risk of being prescribed the last-line-of-antibiotic-defense. Men who have sex with men had an 48.7% increased risk of being prescribed the last-line-of-antibiotic-defense. Sexual orientation had a 16% increased risk of being prescribed the last-line-of-antibiotic-defense. There are five factors that may have a protective effect, and these are race/ethnicity, gender, pregnancy, knowing HIV status, and was paid for sex. Of these factors, gender has the greatest protective effect. Within gender alone as an internal comparison, an odds ratio was conducted for males versus females (female versus male, OR = 0.829 (95% CI: 0.799, 0.860). Females have a less likelihood of being prescribed the last-line-of-antibiotic-defense versus males (OR = 0.952 (95% CI: 0.942, 0.961)) and males have a 5.2% greater likelihood of being prescribed the last-line-of-antibiotic-defense.

Risk-factor comparisons for the Regions

Every region with the accept of the North Central Region shares one common increased risk factor of statistical significance that has an increased likelihood for being prescribed the last-line-of-antibiotic-defense. That risk factor is age ranges. The North

Central Region also has age range as an increased likelihood for being prescribed the last-line-of-antibiotic-defense but based on a p-value of 0.05 it was not considered statistically significant. Had the p-value been 0.10 then it would have been considered statistically significant. The Northwest Region, the North Central Region, and the East Central Region, shared some level of condom use as having an increased likelihood for being prescribed the last-line-of-antibiotic-defense. The North East Region and the Southwest Region shared oral sex with a female as having an increased likelihood for being prescribed the last-line-of-antibiotic-defense.

Protective Factor Comparisons for the Regions

All regions shared a statistically significant protective factor and that was pregnancy. There were other statistically significant protective factors that had commonality in the Regions. All regions except for the Southwest Region shared the protective factor and a reduced risk for being prescribe the last-line-of-antibiotic-defense for those who knew their HIV status. There were other shared common protective factors for some of the Regions. Race/ethnics was shared for the North Central Region, the West Central Region, the East Central Region, and the South Region. Gender was shared for the Northeast Region, the North Central Region, the West Central Region, the East Central Region, and the South Region. Sexual orientation was shared with the Northwest Region, the North Central Region, the West Central Region, Southeast Region, and the Southwest Region. The South East Region and the South Region shared those who were paid for sex as a protective factor. The remaining statistically significant protective factors within each region are unique to those areas.

Protective and Risk-factor comparisons for the Regions

In some instances, a protective factor in one region became a risk factor in another region. Men who have sex with men is considered a protective factor in the Northwest Region, the North Central Region, the West Central Region, and the Southeast Region but is a risk factor in the South Region. Sexual orientation is considered a protective factor in the Northwest Region, the North East Region, the North Central Region, the West Central Region, Southeast Region, and the Southwest Region but is a risk factor in the South Region. Incarcerated within the last 12 months from the time of the infection was a protective factor in the Northeast Region but was a risk factor in the Southeast Region.

Risk-factor comparisons for the Regions and State

Florida and every region with the accept of the North Central Region shares one common increased risk factor of statistical significance that has an increased likelihood for being prescribed the last-line-of-antibiotic-defense. That risk factor is age ranges. The state of Florida, the North East Region, and the Southwest Region shared oral sex with a female as having an increased likelihood for being prescribed the last-line-of-antibiotic-defense. No other increased likelihood for being prescribed the last-line-of-antibiotic-defense risk factors were shared among Florida and the regions (Table 11). Florida and regions had unshared risk factors for the increased likelihood for being prescribed the last-line-of-antibiotic-defense. For instance, Florida had vaginal or anal sex unprotected with a male; the Northwest Region had for those who had history of STD any time in their past; the Northeast Region had an increased risk for a number of sex partners; the

Southeast Region had an increased risk for those who incarcerated within the last 12 months since the time of the infection; and the South region had an increased risk for those men who had sex with men and sexual orientation (Table 11).

Protective Factor Comparisons for the Regions and State

Florida and all regions shared a statistically significant protective factor and that was pregnancy. There were other statistically significant protective factors that had commonality in the Regions and the State. Florida and all regions except for the Southwest Region shared the protective factor and a reduced risk for being prescribe the last-line-of-antibiotic-defense for those who knew their HIV status. There were other shared common protective factors for some of the Regions and State. Race/ethnics was shared for the state of Florida, the North Central Region, the West Central Region, the East Central Region, and the South Region. Gender was shared for the state of Florida, the Northeast Region, the North Central Region, The West Central Region, the East Central Region, and the South Region. Sexual orientation was shared with the Northwest Region, the North Central Region, the West Central Region, Southeast Region, and the Southwest Region. Florida and the Southwest Region shared history of an STD in the last 12 months from the time of infection as a protective factor. The South East Region and the South Region shared those who were paid for sex as a protective factor. The remaining statistically significant protective factors within Florida and each region are unique to those areas (Table 11).

Protective and Risk-factor Comparisons for the Regions and State

In some instances, a protective factor in one region or the state became a risk factor in another region or for the State. Condom use always is a protective factor in Florida but a risk factor in the East Central Region. In Florida having a history of an STD at any time is a protective factor but is a risk factor in the Northwest Region. Also, in Florida always using condoms is a protective factor but in the East Central Region it is considered a risk factor. A similar comparison but not exact is that vaginal or anal unprotected sex with a male is a risk factor in the state of Florida, but vaginal or anal sex with a male is considered a protective factor in the Southeast Region (Table 11).

Table 11

Risk Factors are in Red and Protective Factors in Black for Florida and Eight Regions

State of Florida	Northwest Region	Northeast Region	North Central Region	West Central Region	East Central Region	Southeast Region	Southwest Region	South Region
Race/ Ethnics			Race/ Ethnics	Race/ Ethnics	Race/ Ethnics			Race/ Ethnics
Age Range	Age Range	Age Range		Age Range	Age Range	Age Range	Age Range	Age Range
Gender		Gender	Gender	Gender	Gender			Gender
	Men who have Sex with Men		Men who have Sex with Men	Men who have Sex with Men		Men who have Sex with Men		Men who have Sex with Men
	Sexual Orientation	Sexual Orientation	Sexual Orientation	Sexual Orientation		Sexual Orientation	Sexual Orientation	Sexual Orientation
Pregnancy	Pregnancy	Pregnancy	Pregnancy	Pregnancy	Pregnancy	Pregnancy	Pregnancy	Pregnancy
					Drug Use			
Condom Use Always					Condom Use Always			
	Condom Use Sometimes	Condom Use Sometimes						
	Condom Use Never							
			Condom Use with other Partner					
		New Partner w/in 90 days						
		No. of Sex Partners						

Aware of HIV Status	Aware of HIV Status	Aware of HIV Status	Aware of HIV Status	Aware of HIV Status	Aware of HIV Status	Aware of HIV Status	Aware of HIV Status	Aware of HIV Status
						Was Paid for Sex		Was Paid for Sex
				Vaginal or Anal Sex with Female				
Oral Sex with Female		Oral Sex with Female					Oral Sex with Female	
			Oral Sex with Male					
						Vaginal or Anal Sex with Male		
Vaginal or Anal Sex with Male Unprotected								
History of an STD	History of an STD							
History of an STD in the Last 12 Months							History of an STD in the Last 12 Months	
		Incarcerated in the last 12 months				Incarcerated in the last 12 months		
					Victim Sexual Assault	Victim Sexual Assault		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Summary

The data provided by Florida presented significant findings. These findings indicate that there are statistically significant predictive risk factors related to antimicrobial resistant gonorrhea. The findings also indicate that there are variations between Florida as a whole and the individual regions. No region, nor Florida shared the exact same results. Each had its own unique and specific risk factors. Thus, further supporting the intended purpose of this study. The research questions were able to be successfully answered and provided statistically significant insight. The results of this will be discussed further in Chapter 5.

Chapter 5: Discussion

Introduction

The purpose of this study was to identify at-risk groups for contracting drug-resistant gonorrhea. Drug resistance is driven by overuse of antibiotics. The CDC as well as work conducted by Alirol et al. (2017), Barbee (2014), Chesson et al. (2014), Hooke et. al. (2013), Kirkcaldy (2016), Marti et al. (2016), Tapsall et al. (2009), Tuite et al. (2017), Unemo and Shafer (2014), Ventola (2015), Whiley et al. (2012), and Wi et al. (2017), indicated that there is only one effective last-line-of-antibiotic-defense left and continued use of this last-line-of-antibiotic-defense will lead to complete drug resistance. Unless new antibiotics are derived, it is only a matter of time before there is no cure. In March of 2018, the first fully drug-resistant strain of gonorrhea emerged (Ducharme, 2018). Since there is currently only one CDC recommended treatment for drug-resistant gonorrhea, aggressive targeted interventions will be the next step. It is important to identify who these at-risk individuals are. The identification process was based on the prescribed last-line-of-antibiotic-defense. Comparisons were conducted between the last-line-of-antibiotic-defense and demographic and risk factors to provide statistically significant models. This information can now be used to develop targeted interventions.

As mentioned in earlier chapters, demographics change throughout the state of Florida. The state was split into eight different regions as assigned by the FDOH (Figure 1). The results indicated that each region has differences from one another and the state of Florida. The statistically significant factors are not fully uniform from region to region, nor in comparison to the state. Although there are some similar characteristics, findings

indicate that those who are at-risk for contracting drug-resistant gonococcal infections vary differently among the different regions and Florida.

The secondary data on risk factors for gonococcal infection were provided by the FDOH for this study. The data were statistically evaluated to identify the statistically significant at-risk groups for contracting drug-resistant strains of gonorrhea for Florida as well as eight different regions of the state. The concept of contracting drug-resistant strains can be looked at in two different ways: (a) One can directly contract a drug-resistant strain from someone who is carrying the drug-resistant strain. (b) The gonococcal strain can become drug resistant within the individual (Reygaert, 2018). This can occur through transduction between reservoir bacteria in the *Neisseria* genus (Igawa, 2018; Wadsworth, Arnold, Sater, & Grad, 2018). Currently, gonorrhea has begun to become resistant to the last line of antibiotic treatment and it is also believed to be driven through reservoir bacteria in the *Neisseria* genus (Igawa, 2018; Martin et al., 2019). A study by Sánchez-Busó and Harris (2019) looked at genomics to understand the pathway mechanisms. They indicated that not only is drug-resistant gonorrhea being passed in high-risk groups, but it may also be silently spreading in the low-risk groups, thus leading to a public health crisis.

Since Florida stopped monitoring for drug resistance in 2013, and tested for drug resistance only in select populations, this study was challenging to conduct. First, the drug-resistant gonococcal data were biased and could not be used because not all infected individuals were tested. The state only tested those groups that were identified as high risk by the CDC and those demographic groups do not necessary coincide with the

diverse demographics within the state of Florida. Additionally, there was only one testing site in the entire state of Florida from the 1990's to 2013. This testing site was located in the South Region making it difficult for individuals residing in other areas of the state to access. Because there was no significant data directly related to drug resistance, this study took a different approach that was supported by the literature and evaluated risk factors and demographics that were at-risk for being prescribed the last-line-of-antibiotic-defense. This in turn elucidates the most likely groups to develop, contract, and evolve drug-resistant gonorrhea. The findings were then used to develop a predictive model for drug resistance for Florida and the eight Florida regions. Ultimately the goal is to utilize these findings to create targeted interventions to prevent, slow, or even stop the spread of drug-resistant variants in the state of Florida.

Interpretation of the Findings

There were descriptive statistics that were incorporated into the interpretation of the findings. The biggest populations for contracting gonorrhea were heterosexuals (74.2%), African American (52.9%), males (54.3%) and under the age of 30 years (73%). The highest concentration of infections were those ages 20 to 24 years. Other key factors that stood out was that unprotected sex (94.7%) and having a history of an STD (60.2%). Preventative measures would focus on these key demographics and risk factors. There also needs to be intervention focus on those who have had and STD. This information can be presented at the time of diagnosis with emphasis on drug resistance. Safe sex practices will always need emphasis

The descriptive statistics elucidated some interesting findings per each region. The Northwest Region's largest populations for contracting gonorrhea were heterosexuals (89.2%), African Americans (43.7%), females (52.1%), and those under the age of 30 years (76.8%). The highest concentration of infections were those ages 20 to 24 years (33.4%). Other key factors that stood out was that unprotected sex either vaginal or anal with a man and having a history of an STD. The Northeast Region's largest populations for contracting gonorrhea were heterosexuals (79.1%), African Americans (67.5%), males (51.5%), and those under the age of 30 years (73.7%). The highest concentration of infections was individual between ages 20 to 24 years (33.2%). Other key factors that stood out were that unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD. The North Central Region's largest populations for contracting gonorrhea were heterosexuals (88.7%), African Americans (59%), females (52.6%), and those under the age of 30 years (90.5%). Other key factors was sex while intoxicated and drug use among the infected. As for age, the highest concentration of infections were those ages 20 to 24 years (37.2%). Other key factors that stood out was that unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD.

The West Central Region's largest populations for contracting gonorrhea were heterosexuals (79.4%), African Americans (53.3%), males (52.2%), and those under the age of 30 years (74.1%). As for age, the highest concentration of infections were those ages 20 to 24 years (32.2%). Other key factors that stood out was that unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD.

Drug use was also a factor in this region. The East Central Region's largest populations for contracting gonorrhea were heterosexuals (79.4%), African Americans (53.3%), males (52.1%) and those under the age of 30 years (74.1%). As for age, the highest concentration of infections were those ages 20 to 24 years (32.3.%). Other key factors that stood out was that unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD. Drug use was also a factor in this region.

The Southeast Region's largest populations for contracting gonorrhea were heterosexuals (86.6%), African Americans (58%), males (52.3%), and those under the age of 30 years (72.4%). As for age, the highest concentration of infections were those ages 20 to 24 years (31.9%). Other key factors that stood out was that unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD. Drug use was also a factor in this region. The Southwest Region's largest populations for contracting gonorrhea were heterosexual (85.7%), African Americans (45.2%), males (50.8%) and those under the age of 30 years (75.8%). As for age, the highest concentration of infections were those ages 20 to 24 years (32.4%). Other key factors that stood out were unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD. Drug use was also a factor in this region. The South Region's largest populations for contracting gonorrhea were homosexuals (48.2%), African American (47.4%), males (63.9%) and those under the age of 30 years (67.2%). It is also important to note that 20.3% of the infected population was Hispanic. As for age, the highest concentration of infections were those ages 20 to 24 years (28.8%). There is a larger increase in the Hispanic population in this area in comparison to other

regions. Other key factors that stood out was that unprotected sex either vaginal or anal with a man, oral sex with a man, and having a history of an STD. Drug use was also a factor in this region.

Overview

All of the regions and Florida share some commonalities, but none are exactly the same to each other. This indicates that each region and Florida, each have their own unique risk factors. The core common demographics for gonococcal infections are those African American and those under the age of 30 years with the highest concentration in the age range of 20 to 24 years. Gender changes depending on region but begins to concentrate in males as one moves south in the State. Along this southern movement drug use, men who have sex with men, and the infections in the Hispanic population became more prominent. This is reflective of the demographic changes that occur when one moves from the northern end to the southern end of the State. The northern end of the state to the central and west central area is primarily farming, rural, and is considered conservative. As one moves south the state becomes more populated and drifts to a less conservative, high paced, wealthy, and celebratory atmosphere. Risk factors that were consistent across the regions and the state were lack of condom use (safe sex practices) and had a history of a prior STD. This is an important finding. Repeated gonococcal infections in the same population coupled with the use of last-line-of-antibiotic-defense, which the dominantly prescribe medication in all regions and the State, increases the chances of developing drug-resistant strains.

Research Question 1: Are there differences in using last line antibiotic defense between Florida as a whole and each of the eight regions?

The differences were compared using Chi-square and cross-tabulation analysis. The findings support that there are variations among the regions in relationship to the state indicating that last-line-of-antibiotic-defense may drive drug resistance differently by region verses the State. Comparing the state to all the regions, across the board the state as a whole the last-line-of-antibiotic-defense was prescribed higher in compared to some regions and lower compared to other regions. For instance, with ethnics, the last-line-of-antibiotic-defense was prescribed higher in the Northwest, Northeast, North Central, West Central, Southeast, and Southwest Regions than the state of Florida, whereas the last-line-of-antibiotic-defense was prescribed at a lower rate for the East Central and South Regions than the state of Florida. These findings were statistically significant for every region except for the Southwest region.

Research Question 2: Are there differences in using last-line-of-antibiotic-defense among the eight Florida regions?

The regions were compared to one another using Chi-square and cross tabulation analysis. The regions were compared to each other. The East Central region was prescribed the last-line-of-antibiotic-defense at a higher rate than five of the seven other regions. The South region was prescribed the last-line-of-antibiotic-defense at a higher rate than four of the seven other regions. The Northwest, Northeast, and North Central regions were prescribed the last-line-of-antibiotic-defense at a rate higher than three of the seven other regions. The West Central region was prescribed the last-line-of-

antibiotic-defense at a rate higher than two of the seven other regions. The Southeast region was prescribed the last-line-of-antibiotic-defense at a rate higher than one of the seven other regions. The Southwest region was prescribed the last-line-of-antibiotic-defense at a rate lower than the seven other regions. Based on these findings it can be elucidated that the East Central and South regions have a high probability of developing drug resistance strains of gonorrhea. This indicates that residents in these regions are at a higher risk of contracting drug-resistant gonorrhea.

Research Question 3: What are the statistically significant factors associated with being treated with last-line-of-antibiotic-defense in each of the eight regions and the state of Florida?

A multiple logistic regression calculation was conducted to identify predictive risk and demographic factors. Inclusive a calculation for Florida was conducted to use as a comparison.

Northwest Region

The final results indicate for the Northwest Region, there were four risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment. They were age, sometimes using condoms, never using condoms, and history of an STD. Overall, the age groups that had the highest rates among the total infected population were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age groups not only were the majority of the infection, but they were most often prescribed the last-line-of-antibiotic-defense at rates of 80% or greater. The lack of condom use leading to unprotected sex, is a risk factor. Having a prior history of

an STD is also a risk factor. Contrary to the CDC statement that men who have sex with men are at-risk it seems that in this region men who have sex with men are a protective factor. Inclusive of protection is sexual orientation, awareness of HIV status, and pregnancy. Targeted intervention for the Northwest Region should focus on individuals ages 16 to 29 years and who have had a history of a prior STD. In addition, emphasis needs to focus on condom use. This would also reduce the chance of drug resistance.

Northeast Region

The final results indicate for the Northeast Region, there were three risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment. These were age, number of sex partners, and oral sex with a female. Overall, the age groups that had the highest rates of gonococcal infections were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age groups not only were the majority of the infection, but they were most often prescribed the last-line-of-antibiotic-defense at rates of 79% or greater. The number of sex partners and oral sex with a female are also considered a risk factor compared to other factors. Protective factors are gender, sexual orientation, pregnancy, sometimes using condoms, new partner within the first 90 days, aware of HIV status, and incarcerated within 12 months of the time of the infection. Other protective factors such as sexual orientation and awareness of the HIV status may contribute to a greater awareness of sexually transmitted diseases thus greater care maybe utilized during sexual contact. If a targeted intervention would be created for the Northeast Region, it is recommended that it be focused an age, especially those between the ages of 16 and 29 years.

North Central Region

Interestingly, in this region the only risk factor is the lack of condom use with the other partner in relationship to their main partner where condom use was regularly practiced. Age would have been a risk factor if $p<0.10$ instead of $p<.05$. There were no other significant risk factors. The rest were protective factors such as race/ethnics, gender, men who have sex with men, sexual orientation, pregnancy, oral sex with men, and aware of HIV status. This may be due to the remoteness of the North Central Region in comparison to the rest of the state of Florida. There are two semi-major cities: Tallahassee and Gainesville. Tallahassee is the capital of Florida and the population is only considered large when government is in session and Florida state University is hosting courses. Gainesville population is only considered large when the University of Florida is hosting courses. During the offseason, the population decreases in those areas. In addition, during the reporting of an infection, a patient's home location is normally reported. Considering these two cities are transient due to the two universities and government headquarters, the reporting of the infection may be assigned to a different geographical location in the State. As for targeted intervention, this region hosts the two of the three largest universities in Florida targeted intervention should still focus on young adults, the age groups between the age of 16 and 29 years. Although age was considered statistically not significant based on a $p< 0.05$ if one were to base statistical significance on a $p<0.10$ being statistically significant then age would be considered statistically significant. Greater than 80% of the individuals in these age categories received the last-line-of-antibiotic-defense.

West Central Region

The final results indicate for the West Central Region, there were two risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment. These are age. Overall, the age groups that had the highest rates of gonococcal infections were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age groups not only were the majority of the infection, but they were often prescribed the last-line-of-antibiotic-defense at rates of 84% or greater. Protective factors include race/ethnics, gender, men who have sex with men, sexual orientation, pregnancy, aware of HIV status, and vaginal or anal sex with a female. If a targeted intervention were created for the West Central Region, it is recommended that it be focused a specific age group, especially those between the ages of 16 and 29 years.

Southeast Region

The final results indicate for the Southeast Region, there are two risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment. These were age and incarcerated within the last 12 months from the time of the infection. Overall, the age groups that had the highest rates of gonococcal infections were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age groups not only were the majority of the infection, but they were often prescribed the last-line-of-antibiotic-defense at rates of 72% or greater. This was much lower than in other regions, none the less still a high level overall. Protective factors include gender, men who have sex with men, sexual orientation, pregnancy, aware of HIV status, was paid for sex, and vaginal or anal sex with a male. Although it may be

considered a risk factor, an individual who is paid for sex may be more aware of the possibilities of STD infections and will take additional precautions. If a targeted intervention would be created for the Southeast Region, it is recommended that it be focused some specific age groups, especially those between the ages of 16 and 29 years.

Southwest Region

The final results indicate for the Southwest Region, there are two risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment. These were age and oral sex with a female. Overall, the age groups that had the highest rates of gonococcal infections were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age groups not only were the majority of the infection, but they were often prescribed the last-line-of-antibiotic-defense at rates of 85% or greater. Protective factors sexual orientation, pregnancy, aware of HIV status, and had a history of an STD in the last 12 months from the time of the infection. If a targeted intervention would be created for the southwest region, it is recommended that it be focused some specific age groups, especially those between the ages of 16 and 29 years.

South Region

The final results indicate for the South Region, there are three risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment. These were age, men who have sex with men (MSM), and sexual orientation. Overall, the age groups that had the highest rates of gonococcal infections were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age

groups not only were the majority of the infection, but they were often prescribed the last-line-of-antibiotic-defense at rates of 85% or greater. Additionally, the South Region which encompasses a large LGBT population which host large city-wide events regularly. It is also an international tourist hotspot. Fort Lauderdale, Miami, Miami Beach, and Key West are located in this region. These cities are known for extravagant lifestyles and nightlife. Miami hosts a large Latin American population and the culture celebrates regularly and extravagantly in Miami. Brazilian Carnival and Carnival de Barranquilla are some of the largest Latin costume-based festivals that attract a variety of individual. The free-living lifestyle is well known in the south region and among the LGBT community. Thus, LGBT population can be considered at-risk in this region. Protective factors race/ethnics, gender, pregnancy, aware of HIV status, and was paid for sex. If a targeted intervention would be created for the southwest region, it is recommended that it be focused an age, especially those between the ages of 16 and 29 years.

State of Florida

The final results indicate for the state of Florida, the risk factors contributing to drug resistance by being prescribed the last line of antibiotic treatment were 1) age range, 2) oral sex with a female, and 3) unprotected vaginal or anal sex with a male. These groups are most at-risk for contracting or developing drug resistance. Overall, the age groups that had the highest rates of gonococcal infections were those between the ages of 20 to 24 years then followed by 16 to 19 years and 25 to 29 years. These age groups not only were the majority of the infection, but they were often prescribed the last-line-of-

antibiotic-defense at rates of 80% or greater. This then can be interpreted that those in these age categories are most likely to contract or develop drug-resistant strains of gonorrhea. Oral sex is often performed without a condom and can lead to infections. Having unprotected vaginal or anal sex with a male is also a mechanism for transmission of the infections. This can include females or males having unprotected sex with a male. Again, having unprotected sex can drive infections. From a Statewide perspective, targeting the ages 16 to 29 years would have the greatest impact. These are the highest groups for infection as well as being prescribed the last-line-of-antibiotic-defense. Adding condom use will reduce the chances of contracting drug-resistant gonorrhea as well as evolving drug-resistant gonorrhea. This is evident since in Florida results, always using condoms is considered a protective factor. Interesting enough knowing one's HIV status was a protective factor not only in the state but in all regions. This may indicate that those who are aware of their HIV status may be more aware of other infections and are more cautious in their sexual behaviors. The same holds true for those who had a history of an STD at any time in their life. This also seems to be a protective factor indicating that they may be more aware of infections. Race/ethnics and gender were also considered protective factors. In Florida and all Regions pregnancy is also a protective factor. Upon further investigation the last-line-of-antibiotic-defense at times is avoided if possible, for pregnant women since those particular antibiotics are not approved to be prescribed to a woman when pregnant unless there is no other option (Davis et al., 1996). In 2019, after the time of the data for this study, the next generation (third variation of the medication) of last-line-of-antibiotic-defenses have been approved to be used with

pregnant women (Arumugham & Cascella, 2019). In the future pregnancy may become a risk factor, but at the time of this study it is considered a protective factor.

The over-arching result of these comparisons were compiled into Table 11. There is a commonality among all the regions and Florida as well as differences. The most common contributing risk factor for driving drug resistance would be age range. From there, secondarily would-be condom use. Each region and Florida had unique risk factors that differed among each other. This indicates that each region and the State are not the same and targeted interventions need to be developed to target each specifically. These results are discussed further in the Developing Targeted Intervention section.

Limitation of the Study

The intent of this study was to identify what demographic and risk factor groups would be most likely to contract drug-resistant variants of gonorrhea. The difficulty with this type of study is that there is little to no data tracking drug resistance in the state of Florida. The state had two tracking locations for drug resistance. They were West Palm Beach from 1987 to 1998 and then Miami from 1998 to 2013. Since 2013 there has been no tracking of drug resistance for the State. These locations are in the southern end of Florida making it difficult for people in the rest of the state to access limiting it to those in the southern parts of the State. Testing at these locations were not broad reaching. If the patient did not fit the CDC recommendations such as men who have sex with men, pregnant, or sex workers then they were not tested. The testing itself was biased. This may have been due to limited funding. This biased data was not sufficient to conduct analysis and was not used for this study. This study was looking at factors outside of the

recommendations by the CDC to identify unknowns and populations that were most likely missed due to bias and biased testing.

The next option was to look at prescribing of the last-line-of-antibiotic-defense treatment as a driving force of drug resistance. From a biological standpoint this is the most logical route. The CDC as well as other researchers have indicated that unless new antibiotics are developed to specifically fight gonorrhea, the last line of antibiotic treatment will soon fail. Currently the last line is cefixime and ceftriaxone either in combination with each other or in combination with other antibiotics such as doxycycline or azithromycin. Eventually continued use of antimicrobials will lead to the evolution of resistance to that antimicrobial. This study evaluated the prescribed last line of antibiotic treatment as the dependent variable against the different demographic and risk factors as a predictor for drug resistance. Not everyone in the data set received the last line of antibiotic treatment. This then provided a yes versus no evaluation that could then be tied to driving forces of antibiotic resistance. There were also other limitations to the prescribed last line of antibiotic treatment data. This information was limited to only initial prescribed treatment. There was no method to identify if the prescribed treatment worked or if further treatments were needed.

There were other limitations with the data. The data collected was only for those who were infected and tested positive for gonorrhea. There was no data regarding those who were not infected or may have tested negative. This limited comparisons and negated some of the research questions. As for the data itself, all sections were completed. There was no missing data. But what was often recorded was either “did not

report" or "refused to answer." These were treated as a no or negative answer since there was no method to prove that the answers were a positive answer. Due to security and privacy issues, no personal data were released. There was no method to contact the infected individual to gain additional information. This limited the research to only the data that was provided. The data failed to identify if the person infected was a repeat gonococcal infection specifically. The data did indicate if they have had an STD in the past or within the last 12 months since the time of their infection, but never identified the type of STD infection. This would have been helpful to look at repeat gonococcal infections coupled with last line of antibiotic treatment as a driving force for antimicrobial resistance.

The data itself may have other biases. Gonococcal infections are mandatory to report in the state of Florida. The information is required by Florida but is reported remotely by many different health care workers across the State. Some data entry sections were stated in ambiguity which could cause confusion among the reporters. There were at times double negative statements. For instance, when it came to drug use, the section was stated as "did not use drugs." A person who did use drugs would have a no answer and someone who does not use drug would have a yes answer. This could cause some confusion when filling out the data quickly, leading to recording bias. Without the reporters carefully reading and understanding what was being asked, it could have been reported incorrectly. Again, due to security and privacy issues, there was no method in which to confirm if the reporting was done correctly. The data set held over 37 million

data points combined with no connective data being included, making it impossible to confirm that every data point was entered correctly.

Florida Department of Health specifically stated that some additional data were not going to be supplied. They specifically stated that no data with anyone under the age of 16 years was going to be provided. They did not state directly why this was so, but it was elucidated that it could be a number of the following reasons such as indicating sexual molestation of a minor, they did not want information regarding gonococcal infections with minors reported to the public, or worries over community concerns. This limited the data to those 16 years and older and primarily adults. This limits an understanding to what extent if any are gonococcal infections affecting high school aged individuals. It is not known if interventions are necessary for freshman and sophomore aged high school students since this data were not made available by the State. Regardless of some of the limiting factors, there was enough data to successfully develop a predictive model for at-risk groups for driving and contracting drug-resistant gonorrhea infections.

Recommendations

Developing Targeted Interventions

No model is ever perfect. When determining who is most likely at risk for drug-resistant gonorrhea, there are many factors that need to be considered. The data that was provided by Florida was evaluated until the statistics in conjunction with statistical significance elucidated targeted risk factors and demographic groups that should be the focus for intervention in the immediate future. The statistics indicated that given a

statewide initiative it would be best to focus funding and person power at age range with emphasis on condom use. It seems that those under the age of 30 years had the highest number of gonorrhea infections. The most significant were those between the ages of 20 to 24 years followed secondarily by those between the ages of 16 to 19 years, and thirdly those between the ages of 25 to 29 years. Additionally, these were not only the majority of those who contracted gonorrhea, but they were also the highest groups that were prescribed the last line of antibiotic treatment. What this means is that this particular age group will be driving drug resistance and thus spreading drug-resistant gonorrhea to others within that age category. For the state of Florida, the mean age for a man to be married for the first time is 29.4 years and for a woman it is 28.2 years (United States Census Bureau, 2019). Marriage in general is a commitment to monogamy, which virtually eliminates STD infections provided each person is committed to the relationship in that manner. It can be concluded that those under the age of 30 years especially those between the ages of 20 to 24 years and 16 to 19 years will be the most likely to contract drug-resistant strains of gonorrhea. There are three mechanisms in which to avoid the spread of drug-resistant strains of gonorrhea. The mechanisms are abstinence, proper use of barriers such as dental dams and condoms, and a committed monogamist relationship that has had STD testing prior to sexual contact.

Within each region there are a few additional areas of focus to be included in an intervention strategy. The Northwest region would need to be age range and condom use. Additionally, there seems to be a lack of follow-up education after an infection. Having a prior STD does not dissuade individuals from becoming infected again, creating an

additional risk factor for drug resistance. For the Northwest Region, there would need to be an educational program that focuses on the dangers of contracting STD's repetitively. Northeast Region has a slightly different necessary focus. The additional focus beyond age range and condom use which must be inclusive in the intervention, would be the number of sex partners someone has. Intervention in this area would have to educate the public that the more sex partners you have not only are you more likely of contracting gonorrhea, but you may end up contracting a drug-resistant strain that is incurable. North Central Region just slightly fell short for age range as being statistically significant ($p=0.079$). It is the opinion of this author that it should still be included as a risk factor for intervention purposes. The other aspect was condom usage with another partner. This indicates that the individual has a second relationship outside of the primary and may be careless with the second individual. Same as with Florida the North Central Region needs to focus on the under 30 years of age and condom usage. The only area of focus for the West Central Region is age range. This means that those under the age of 30 are at most risk for drug-resistant gonorrhea. East Central Region is similar to Florida and that is those who are at risk are at 30 years of age and under and proper use of condoms should be added to the intervention programs. The Southeast region also identifies the at-risk category for those who are under the age of 30 years but differs in the fact that it includes those who were incarcerated within 12 months of the infection. This may mean that there is a lack of STD education for those who have been incarcerated. It would be beneficial as part of release programs to teach those individuals that not only are they at risk for contracting gonorrhea they may also be at-risk for contracting drug-resistant strains.

Southwest Region will also need to focus on intervention strategies for those under the age of 30 years. As for the South Region this is where the most drastic shift in at-risk groups exists. The South Region shares the same at-risk category for age range with all the other regions and the state as a whole. Where it differs is that men who have sex with men (MSM) and sexual orientation become a risk factor. The South Region of Florida is well known for its high LGBT populations of which the CDC has identified as a-risk. As mentioned earlier this is also the location of the only testing site for drug-resistant strains thus why the collected drug-resistant data would be biased. For the South Region focus should be on those under the age of 30 years, men who have sex with men, and men who identify as homosexual or bisexual.

Positive Social Change Implications

Any infectious disease can be stopped if there is no receptive host. There are many issues with gonorrhea such as its asymptomatic behavior. From an infectious standpoint, this pathogen is passed through sexual contact. Unfortunately, even in this most modern of times the act of sex, discussion of sex, or thought of sex is considered a taboo topic in many social settings. The discussion of sex often becomes non-existent when the topic of sexually transmitted infections (STI) is introduced. In Florida there is little to no discussion with the public regarding these easily avoidable infections. If individuals would just practice safe sex, have regular medical testing for STI's, and have monogamous relationships, most if not all of the STI's would become eradicated. This is not an unreasonable objective. In order to achieve this possibility, the population needs to understand the importance of infection avoidance. The statistically significant risk

populations in each region need to be educated on the risks of contracting drug-resistant variants and it needs to be done in a direct non-pacifistic manner. It is extremely important that the information is presented to them with methods that would require behavioral modification. As presented in this study the over-arching risk group is age range. The highest incidences and the most prescribed group for last-line-of-antibiotic-defense are those under the age of 30 years with highest concentration in those between the age of 20 to 24 years followed by 16 to 19 years and then 25 to 29 years. In the current age of social media where interactive connections are just a cell phone tap away, there has been a growing trend of "no strings attached" hook-up apps. These apps such as Tinder, Plenty O' Fish, FET Life, Wild, Adult Friend Finder, and the like, all lead to quick sexual encounters without regrets or worries. The greatest demographic group which is highly versed in these phone-based connection apps and use them regularly are those who are between the ages of 16 to 29 years. The highest category of infection and being prescribed the last-line-of-antibiotic-defense is the age group of 20 to 24 years followed by 16 to 19 years and then 25 to 29 years. Since gonorrhea can be asymptomatic an individual who is sexually active may be a "super spreader" of this infection. Additionally, the spread is greatly attributed to the manner in which people interact with each other sexually, interventions of this magnitude will only be successful if the societal understandings, approaches, discussions, and attitudes towards sex, change. There needs to be a well-driven-home message that casual sex in this day and age can lead to gonorrhea infections that are uncurable and the message needs to reach those especially under the age of 30 years.

Conclusion

This study answered the question of who would be most at-risk for contracting or developing drug-resistant strains of gonorrhea in each region and Florida. Each region and Florida have unique risk factors that differ from each. Although each has its own unique risk factors, there was a common risk factor shared. In all statistical models conducted in this research, age was the most common and repetitive risk factor. Often individuals have sexual relationships within their age groups. Connecting high rates of prescribing last-line-of-antibiotic-defense with high rates of infection within the same group, there is a significant chance that the group will develop drug-resistance and then pass the drug-resistant variant to others within the group. Florida needs to focus on safe sex practices and emphasize that contracting drug-resistant gonorrhea is possible and most likely for those under the age of 30 years. Considering the average age of first marriages in the state are is 29.4 years for a male and 28.2 years for a woman. There is a significant chance that those below these ages are sexually active. With the many different "hook up" sites promoting random inconsequential sexual encounters, just supports that under the age of 30 years are most like to be the driving force. Coupled with age, each region needs to focus on the additional risk factors unique to each. The combined effort will maximize the success of prevention.

Future studies would focus on of those who have contracted gonorrhea, identify who has contracted drug-resistant strains and who has contracted regular strains in all infected individuals and not just select groups. This would provide a more precise understanding of who is at-risk of contracting and spreading drug-resistant gonococcal

infections. But before this type of study can be conducted Florida needs to test for drug-resistant strains in all infected individuals. This would provide a stronger identification of who would be at-risk for contracting drug-resistant strains. With this knowledge more realistic interventions can be conducted. Although the United States is a diverse nation, nationwide focus is not always effective. Regional and community-based focus should be the goal.

A second area of future research in gonococcal infections would focus on the local communities and identify clusters of gonococcal infections. The state had expressed concerns that this could be culturally problematic. Areas with heavy religious influence may not appreciate studies such as this in their community. Although identifying clusters is helpful, there may be community resistance. Being able to identify clusters would significantly narrow the focus of intervention and culturally sensitive interventions could be created.

A third area of future research would evaluate the influences of "hook up" sites and apps on the contraction and spread of gonococcal infections. Many of these sites are how individuals, especially those 30 years and under, meet others for sexual connections or long-term relationships. Within the research it would also be interesting to see if these sites drive drug resistance or pass drug-resistant strains. Through these sites it could be possible to perform contact tracing, infection tracking, and cluster mapping.

A final area of future research is to evaluate comorbidity. The study would identify if there were other STD infections at the time of the gonococcal infection occurred. Gonorrhea is known to be asymptomatic in many cases. It would be interesting

to study if gonococcal infections had influence on other infections such as HIV/AIDS. Questions such as does a gonococcal infection make it easier to contract other STD's such as HIV/AIDS? Do some individuals contract other STD's at the same time they contracted gonorrhea? These areas of research would help develop a better understanding of how gonorrhea spreads, becomes drug resistant, and is influenced by anthropogenic means for the state of Florida.

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Appendix A: Results of the Cross-Tabulations Associated with the Comparing Florida as a Whole with the Eight Regions

Table A1

Results of Cross Tabulation Comparing Florida as a Whole with the Northwest Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense Northwest Region						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
Northwest Region Last Line Antibiotic	Did Not Report	Count	352	937	146	1435
		Within Northwest Region Last-line-of-antibiotic-defense	24.5%	65.3%	10.2%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	9.4%	8.1%	9.0%	8.5%
		Total	2.1%	5.5%	0.9%	8.5%
	Last-line-of-antibiotic-defense	Count	3196	9804	1379	14379
		Within Northwest Region Last-line-of-antibiotic-defense	22.2%	68.2%	9.6%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	85.0%	84.8%	84.8%	84.9%
		Total	18.9%	57.9%	8.1%	84.9%
	Not Effective Antibiotic	Count	213	817	102	1132
		Within Northwest Region Last-line-of-antibiotic-defense	18.8%	72.2%	9.0%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	5.7%	7.1%	6.3%	6.7%
		Total	1.3%	4.8%	0.6%	6.7%
Total		Count	3761	11558	1627	16946
		Within Northwest Region Last-line-of-antibiotic-defense	22.2%	68.2%	9.6%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	22.2%	68.2%	9.6%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table A2

Results of Cross Tabulation Comparing Florida as a Whole with the North Central Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense North Central Region						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
North Central Region Last Line Antibiotic	Did Not Report	Count	712	2368	339	3419
		Within North Central Region Last-line-of-antibiotic-defense	20.8%	69.3%	9.9%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	11.5%	11.7%	11.8%	11.7%
		Total	2.4%	8.1%	1.2%	11.7%
	Last-line-of-antibiotic-defense	Count	4967	16475	2342	23784
		Within North Central Region Last-line-of-antibiotic-defense	20.9%	69.3%	9.8%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	80.0%	81.7%	81.8%	81.3%
		Total	17.0%	56.3%	8.0%	81.3%
	Not Effective Antibiotic	Count	529	1330	183	2042
		Within North Central Region Last-line-of-antibiotic-defense	25.9%	65.1%	9.0%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	8.5%	6.6%	6.4%	7.0%
		Total	1.8%	4.5%	0.6%	7.0%
Total		Count	6208	20173	2864	29245
		Within North Central Region Last-line-of-antibiotic-defense	21.2%	69.0%	9.8%	100.0%

		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	21.2%	69.0%	9.8%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table A3

Results of Cross Tabulation Comparing Florida as a Whole with the Northeast Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense Northeast Region						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
Northeast Region Last Line Antibiotic	Did Not Report	Count	791	2483	337	3611
		Within Northeast Region Last-line-of-antibiotic-defense	21.9%	68.8%	9.3%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	11.6%	10.6%	10.4%	10.8%
		Total	2.4%	7.4%	1.0%	10.8%
	Last-line-of-antibiotic-defense	Count	5520	18929	2597	27046
		Within Northeast Region Last-line-of-antibiotic-defense	20.4%	70.0%	9.6%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	81.2%	80.4%	80.3%	80.6%
		Total	16.4%	56.4%	7.7%	80.6%
	Not Effective Antibiotic	Count	487	2121	299	2907
		Within Northeast Region Last-line-of-antibiotic-defense	16.8%	73.0%	10.3%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	7.2%	9.0%	9.2%	8.7%
		Total	1.5%	6.3%	0.9%	8.7%

Total	Count	6798	23533	3233	33564
	Within Northeast Region Last-line-of-antibiotic-defense	20.3%	70.1%	9.6%	100.0%
	Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
	Total	20.3%	70.1%	9.6%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table A4

Results of Cross Tabulation Comparing Florida as a Whole with the West Central Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
West Central Region Last Line Antibiotic	Did Not Report	Count	823	3547	446	4816
		Within West Central Region Last-line-of-antibiotic-defense	17.1%	73.7%	9.3%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	6.1%	7.9%	7.8%	7.5%
		Total	1.3%	5.5%	0.7%	7.5%
	Last-line-of-antibiotic-defense	Count	11767	37867	4841	54475
		Within West Central Region Last-line-of-antibiotic-defense	21.6%	69.5%	8.9%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	86.5%	84.4%	84.8%	84.9%
		Total	18.3%	59.0%	7.5%	84.9%
	Not Effective Antibiotic	Count	1006	3473	422	4901
		Within West Central Region Last-line-of-antibiotic-defense	20.5%	70.9%	8.6%	100.0%

		Within state of Florida Last Line of Antibiotic Treatment	7.4%	7.7%	7.4%	7.6%
		Total	1.6%	5.4%	0.7%	7.6%
Total		Count	13596	44887	5709	64192
		Within West Central Region Last-line-of-antibiotic-defense	21.2%	69.9%	8.9%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	21.2%	69.9%	8.9%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table A5

Results of Cross Tabulation Comparing Florida as a Whole with the East Central Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
East Central Region Last Line Antibiotic	Did Not Report	Count	2467	6542	737	9746
		Within East Central Region Last-line-of-antibiotic-defense	25.3%	67.1%	7.6%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	22.0%	19.4%	18.9%	20.0%
		Total	5.1%	13.4%	1.5%	20.0%
	Last-line-of-antibiotic-defense	Count	7842	24826	2922	35590
		Within East Central Region Last-line-of-antibiotic-defense	22.0%	69.8%	8.2%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	70.1%	73.6%	74.8%	72.9%

		Total	16.1%	50.8%	6.0%	72.9%
	Not Effective Antibiotic	Count	884	2369	247	3500
		Within East Central Region Last-line-of-antibiotic-defense	25.3%	67.7%	7.1%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	7.9%	7.0%	6.3%	7.2%
		Total	1.8%	4.9%	0.5%	7.2%
Total		Count	11193	33737	3906	48836
		Within East Central Region Last-line-of-antibiotic-defense	22.9%	69.1%	8.0%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	22.9%	69.1%	8.0%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table 1

Results of Cross Tabulation Comparing Florida as a Whole with the Southwest Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
Southwest Region Last Line Antibiotic	Did Not Report	Count	38	213	32	283
		Within Southwest Region Last-line-of-antibiotic-defense	13.4%	75.3%	11.3%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	2.8%	3.6%	2.9%	3.4%
		Total	0.5%	2.5%	0.4%	3.4%
		Count	1270	5327	1009	7606

	Last-line-of-antibiotic-defense	Within Southwest Region Last-line-of-antibiotic-defense	16.7%	70.0%	13.3%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	92.1%	90.2%	90.0%	90.5%
		Total	15.1%	63.3%	12.0%	90.5%
	Not Effective Antibiotic	Count	71	369	80	520
		Within Southwest Region Last-line-of-antibiotic-defense	13.7%	71.0%	15.4%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	5.1%	6.2%	7.1%	6.2%
		Total	0.8%	4.4%	1.0%	6.2%
Total		Count	1379	5909	1121	8409
		Within Southwest Region Last-line-of-antibiotic-defense	16.4%	70.3%	13.3%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	16.4%	70.3%	13.3%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table A7

Results of Cross Tabulation Comparing Florida as a Whole with the Southeast Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense Southeast Region						
			Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total
Southeast Region Last Line Antibiotic	Did Not Report	Count	133	728	85	946
		Within Southeast Region Last-line-of-antibiotic-defense	14.1%	77.0%	9.0%	100.0%

		Within state of Florida Last Line of Antibiotic Treatment	3.2%	5.9%	5.1%	5.2%
		Total	0.7%	4.0%	0.5%	5.2%
	Last-line-of-antibiotic-defense	Count	3641	10383	1414	15438
		Within Southeast Region Last-line-of-antibiotic-defense	23.6%	67.3%	9.2%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	88.6%	84.6%	85.1%	85.6%
		Total	20.2%	57.6%	7.8%	85.6%
	Not Effective Antibiotic	Count	334	1156	163	1653
		Within Southeast Region Last-line-of-antibiotic-defense	20.2%	69.9%	9.9%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	8.1%	9.4%	9.8%	9.2%
		Total	1.9%	6.4%	0.9%	9.2%
Total		Count	4108	12267	1662	18037
		Within Southeast Region Last-line-of-antibiotic-defense	22.8%	68.0%	9.2%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	22.8%	68.0%	9.2%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table A8

Results of Cross Tabulation Comparing Florida as a Whole with the South Region for the Last-line-of-antibiotic-defense

Last-line-of-antibiotic-defense				
	Did Not Report	Last-line-of-antibiotic-defense	Not Last-line-of-antibiotic-defense	Total

South Region Last Line Antibiotic	Did Not Report	Count	2561	9228	1369	13158
		Within South Region Last-line-of-antibiotic-defense	19.5%	70.1%	10.4%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	18.8%	20.6%	24.0%	20.5%
		Total	4.0%	14.4%	2.1%	20.5%
	Last-line-of-antibiotic-defense	Count	10415	33050	3996	47461
		Within South Region Last-line-of-antibiotic-defense	21.9%	69.6%	8.4%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	76.6%	73.7%	70.2%	74.0%
		Total	16.2%	51.6%	6.2%	74.0%
	Not Effective Antibiotic	Count	616	2547	328	3491
		Within South Region Last-line-of-antibiotic-defense	17.6%	73.0%	9.4%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	4.5%	5.7%	5.8%	5.4%
		Total	1.0%	4.0%	0.5%	5.4%
Total		Count	13592	44825	5693	64110
		Within South Region Last-line-of-antibiotic-defense	21.2%	69.9%	8.9%	100.0%
		Within state of Florida Last Line of Antibiotic Treatment	100.0 %	100.0%	100.0%	100.0%
		Total	21.2%	69.9%	8.9%	100.0%

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Appendix B: Results of the Multiple Regression for Florida and the Eight Regions

Table B1

All Results of the Multiple Logistic Regression for Florida

Multiple Logistic Regression for the state of Florida

						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.114	.005	1	.000	.892	.883	.901
Age Range	.033	.003	1	.000	1.034	1.028	1.039
Gender	-.613	.050	1	.000	.542	.491	.598
Men Sex with Men	-.030	.025	1	.227	.970	.923	1.019
Sexual Orientation	.006	.008	1	.430	1.006	.991	1.023
Pregnant	-.391	.013	1	.000	.677	.660	.694
Drug Use	.006	.045	1	.891	1.006	.921	1.099
Sex While Intoxicated OR High	.031	.052	1	.547	1.032	.932	1.142
Condom Use Always	-.134	.065	1	.040	.875	.770	.994
Condom Use Sometimes	-.053	.071	1	.450	.948	.826	1.089
Condom Use Never	.053	.070	1	.449	1.054	.919	1.209
Condom Use with Main Partner	-.059	.056	1	.293	.942	.844	1.053
Condom Use with Other Partners	.122	.077	1	.110	1.130	.973	1.313
Sex with Anonymous Partner	-.013	.061	1	.830	.987	.876	1.112
Sex with Partner Met Via Internet	.070	.068	1	.300	1.073	.939	1.226

New Partner Within the Last 90 Days	-.036	.077	1	.640	.965	.830	1.122
Number of Sex Partners	-.013	.008	1	.133	.988	.972	1.004
Pick Up in Bar	.012	.130	1	.929	1.012	.784	1.305
Pick Up in Bath	.035	.122	1	.777	1.035	.814	1.316
HIV Self-Aware	-.085	.013	1	.000	.918	.895	.943
Paid for Sex	-.051	.081	1	.528	.950	.812	1.113
Was Paid for Sex	-.124	.070	1	.079	.883	.769	1.014
Vaginal or Anal Sex with Female	-.039	.061	1	.526	.962	.853	1.085
Oral Sex with Female	.200	.081	1	.014	1.221	1.042	1.432
Unprotected Vaginal or Anal Sex with Female	-.098	.073	1	.175	.906	.786	1.045
Vaginal or Anal Sex with Male	-.005	.049	1	.926	.995	.904	1.096
Oral Sex with Male	.010	.077	1	.895	1.010	.868	1.176
Unprotected Vaginal or Anal Sex with Male	.154	.070	1	.029	1.166	1.016	1.338
Vaginal or Anal Sex with Male who has Sex with Male	-.061	.061	1	.318	.941	.835	1.060
History of Prior STD	-.167	.025	1	.000	.846	.806	.888
History of Prior STD Within Last 12 Months	-.248	.046	1	.000	.781	.713	.854
Incarcerated Within Last 12 Months	-.075	.051	1	.143	.928	.840	1.025
Victim of Sexual Assault	-.061	.070	1	.385	.941	.819	1.080

Constant	-.106	.034	1	.002	.899	

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B2

All Results of the Multiple Logistic Regression for the Northwest Region

Multiple Logistic Regression for the Northwest Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.010	.020	1	.619	.990	.952	1.030
Age Range	.048	.013	1	.000	1.050	1.023	1.077
Gender	.184	.401	1	.647	1.202	.548	2.635
Men Sex with Men	-.646	.201	1	.001	.524	.353	.778
Sexual Orientation	-.510	.051	1	.000	.601	.543	.664
Pregnant	-.444	.054	1	.000	.642	.577	.713
Drug Use	-.172	.222	1	.437	.842	.545	1.300
Sex While Intoxicated OR High	.187	.220	1	.395	1.206	.784	1.855
Condom Use Always	-.610	.321	1	.057	.543	.289	1.020
Condom Use Sometimes	.857	.417	1	.040	2.356	1.041	5.335
Condom Use Never	.864	.315	1	.006	2.372	1.279	4.399
Condom Use with Main Partner	-.260	.273	1	.342	.771	.452	1.317
Condom Use with Other Partners	.251	.335	1	.453	1.286	.667	2.479

Sex with Anonymous Partner	.392	.294	1	.183	1.480	.831	2.633
Sex with Partner Met Via Internet	-.030	.254	1	.906	.970	.590	1.596
New Partner Within the Last 90 Days	.025	.292	1	.932	1.025	.578	1.819
Number of Sex Partners	.064	.039	1	.101	1.066	.988	1.150
Pick Up in Bar	-.583	.345	1	.092	.558	.284	1.099
Pick Up in Bath	.629	.321	1	.050	1.875	1.000	3.516
HIV Self-Aware	-.194	.084	1	.022	.824	.699	.972
Paid for Sex	-.620	.397	1	.119	.538	.247	1.172
Was Paid for Sex	.079	.282	1	.779	1.083	.623	1.883
Vaginal or Anal Sex with Female	.297	.326	1	.362	1.346	.710	2.551
Oral Sex with Female	-.319	.491	1	.516	.727	.278	1.902
Unprotected Vaginal or Anal Sex with Female	.343	.464	1	.460	1.410	.568	3.501
Vaginal or Anal Sex with Male	-.568	.377	1	.132	.567	.271	1.186
Oral Sex with Male	.499	.446	1	.263	1.647	.687	3.950
Unprotected Vaginal or Anal Sex with Male	.463	.453	1	.307	1.589	.654	3.863
Vaginal or Anal Sex with Male who has Sex with Male	-.390	.277	1	.159	.677	.393	1.165
History of Prior STD	.224	.092	1	.015	1.251	1.045	1.499
History of Prior STD Within Last 12 Months	-.198	.282	1	.483	.820	.472	1.426

Incarcerated Within Last 12 Months	-.295	.250	1	.239	.745	.456	1.217
Victim of Sexual Assault	-.364	.232	1	.116	.695	.441	1.094
Constant	-.544	.222	1	.014	.580		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B3

All Results of the Multiple Logistic Regression for the Northeast Region

Multiple Logistic Regression for the Northeast Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.028	.015	1	.075	.973	.944	1.003
Age Range	.060	.008	1	.000	1.062	1.046	1.078
Gender	-.779	.189	1	.000	.459	.317	.665
Men Sex with Men	-.173	.096	1	.070	.841	.697	1.014
Sexual Orientation	-.146	.029	1	.000	.864	.816	.915
Pregnant	-.703	.035	1	.000	.495	.462	.530
Drug Use	.012	.234	1	.959	1.012	.640	1.600
Sex While Intoxicated OR High	.106	.209	1	.611	1.112	.738	1.675
Condom Use Always	.245	.398	1	.538	1.278	.586	2.786
Condom Use Sometimes	-.536	.266	1	.044	.585	.348	.985
Condom Use Never	-.401	.317	1	.206	.669	.359	1.247
Condom Use with Main Partner	.173	.395	1	.660	1.189	.549	2.578

Condom Use with Other Partners	.469	.298	1	.116	1.598	.891	2.864
Sex with Anonymous Partner	.289	.312	1	.353	1.335	.725	2.460
Sex with Partner Met Via Internet	-.251	.329	1	.446	.778	.408	1.484
New Partner Within the Last 90 Days	-.712	.351	1	.043	.491	.246	.977
Number of Sex Partners	.223	.047	1	.000	1.250	1.140	1.371
Pick Up in Bar	.161	.504	1	.749	1.175	.438	3.153
Pick Up in Bath	1.170	.744	1	.116	3.222	.750	13.839
HIV Self-Aware	-.160	.041	1	.000	.852	.787	.923
Paid for Sex	-.530	.357	1	.138	.589	.292	1.186
Was Paid for Sex	-.308	.319	1	.335	.735	.393	1.374
Vaginal or Anal Sex with Female	-.244	.243	1	.316	.783	.486	1.262
Oral Sex with Female	.914	.355	1	.010	2.494	1.244	4.998
Unprotected Vaginal or Anal Sex with Female	-.373	.237	1	.117	.689	.433	1.097
Vaginal or Anal Sex with Male	.048	.216	1	.824	1.049	.687	1.602
Oral Sex with Male	.144	.283	1	.610	1.155	.664	2.010
Unprotected Vaginal or Anal Sex with Male	-.063	.235	1	.788	.939	.592	1.489
Vaginal or Anal Sex with Male who has Sex with Male	.404	.387	1	.297	1.497	.701	3.200
History of Prior STD	-.079	.079	1	.315	.924	.792	1.078

History of Prior STD Within Last 12 Months	.096	.172	1	.576	1.101	.786	1.542
Incarcerated Within Last 12 Months	-.655	.245	1	.007	.519	.322	.839
Victim of Sexual Assault	-.657	.502	1	.190	.518	.194	1.386
Constant	.317	.112	1	.005	1.373		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B4

All Results of the Multiple Logistic Regression for the North Central Region

Multiple Logistic Regression for the North Central Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.048	.017	1	.005	.953	.922	.985
Age Range	.017	.010	1	.079	1.017	.998	1.036
Gender	-.483	.198	1	.015	.617	.418	.909
Men Sex with Men	-.410	.099	1	.000	.663	.546	.806
Sexual Orientation	-.226	.031	1	.000	.797	.750	.848
Pregnant	-1.325	.041	1	.000	.266	.245	.288
Drug Use	-.046	.220	1	.834	.955	.620	1.471
Sex While Intoxicated OR High	.123	.215	1	.567	1.131	.742	1.724
Condom Use Always	-.042	.241	1	.863	.959	.597	1.539
Condom Use Sometimes	.142	.335	1	.671	1.153	.598	2.221
Condom Use Never	.511	.278	1	.066	1.667	.966	2.876

Condom Use with Main Partner	-.004	.232	1	.986	.996	.632	1.570
Condom Use with Other Partners	.690	.289	1	.017	1.993	1.131	3.512
Sex with Anonymous Partner	.131	.308	1	.670	1.140	.623	2.085
Sex with Partner Met Via Internet	-.039	.318	1	.903	.962	.516	1.794
New Partner Within the Last 90 Days	-.591	.428	1	.167	.554	.239	1.281
Number of Sex Partners	-.047	.088	1	.595	.954	.804	1.133
Pick Up in Bar	.723	.826	1	.381	2.060	.409	10.390
Pick Up in Bath	-.650	.745	1	.383	.522	.121	2.247
HIV Self-Aware	-.094	.043	1	.027	.910	.837	.990
Paid for Sex	.795	.471	1	.092	2.215	.879	5.580
Was Paid for Sex	-.115	.348	1	.741	.892	.451	1.762
Vaginal or Anal Sex with Female	-.153	.332	1	.644	.858	.447	1.646
Oral Sex with Female	.205	.379	1	.590	1.227	.583	2.581
Unprotected Vaginal or Anal Sex with Female	-.685	.384	1	.075	.504	.237	1.070
Vaginal or Anal Sex with Male	-.342	.251	1	.173	.711	.435	1.162
Oral Sex with Male	-.864	.346	1	.012	.421	.214	.830
Unprotected Vaginal or Anal Sex with Male	.413	.369	1	.262	1.512	.734	3.113

Vaginal or Anal Sex with Male who has Sex with Male	.390	.327	1	.233	1.478	.778	2.807
History of Prior STD	.009	.131	1	.947	1.009	.781	1.304
History of Prior STD Within Last 12 Months	-.266	.216	1	.219	.766	.502	1.171
Incarcerated Within Last 12 Months	-.219	.309	1	.479	.804	.439	1.471
Victim of Sexual Assault	-.494	.402	1	.219	.610	.277	1.341
Constant	.636	.119	1	.000	1.888		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B5

All Results of the Multiple Logistic Regression for the West Central Region

Multiple Logistic Regression for the West Central Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.062	.011	1	.000	.940	.919	.961
Age Range	.039	.006	1	.000	1.040	1.028	1.053
Gender	-.502	.130	1	.000	.605	.470	.781
Men Sex with Men	-.380	.065	1	.000	.684	.602	.778
Sexual Orientation	-.134	.021	1	.000	.874	.839	.911
Pregnant	-.835	.029	1	.000	.434	.410	.459
Drug Use	-.043	.124	1	.731	.958	.752	1.221
Sex While Intoxicated OR High	-.028	.136	1	.838	.973	.746	1.269

Condom Use Always	.024	.140	1	.863	1.024	.779	1.347
Condom Use Sometimes	.281	.183	1	.126	1.324	.924	1.896
Condom Use Never	.101	.176	1	.566	1.106	.784	1.560
Condom Use with Main Partner	.183	.130	1	.161	1.200	.930	1.549
Condom Use with Other Partners	.296	.197	1	.133	1.344	.914	1.977
Sex with Anonymous Partner	.007	.134	1	.957	1.007	.774	1.310
Sex with Partner Met Via Internet	-.025	.166	1	.882	.976	.705	1.351
New Partner Within the Last 90 Days	.088	.178	1	.623	1.091	.770	1.547
Number of Sex Partners	.012	.011	1	.249	1.012	.991	1.034
Pick Up in Bar	-.623	.369	1	.092	.537	.260	1.106
Pick Up in Bath	.810	.433	1	.061	2.249	.962	5.256
HIV Self-Aware	-.111	.038	1	.003	.895	.832	.964
Paid for Sex	.260	.226	1	.248	1.298	.834	2.019
Was Paid for Sex	-.223	.195	1	.253	.800	.546	1.173
Vaginal or Anal Sex with Female	-.375	.155	1	.015	.687	.507	.931
Oral Sex with Female	.290	.210	1	.168	1.336	.885	2.017
Unprotected Vaginal or Anal Sex with Female	.087	.190	1	.648	1.091	.752	1.582
Vaginal or Anal Sex with Male	-.108	.122	1	.376	.897	.706	1.141
Oral Sex with Male	-.046	.186	1	.807	.955	.663	1.377

Unprotected Vaginal or Anal Sex with Male	.160	.170	1	.345	1.174	.842	1.637
Vaginal or Anal Sex with Male who has Sex with Male	-.061	.149	1	.685	.941	.703	1.261
History of Prior STD	-.077	.063	1	.224	.926	.818	1.048
History of Prior STD Within Last 12 Months	-.009	.099	1	.930	.991	.817	1.203
Incarcerated Within Last 12 Months	-.058	.120	1	.629	.944	.746	1.194
Victim of Sexual Assault	-.408	.234	1	.081	.665	.421	1.052
Constant	.159	.080	1	.047	1.172		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B6

All Results of the Multiple Logistic Regression for the East Central Region

Multiple Logistic Regression for the East Central Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.133	.011	1	.000	.875	.857	.894
Age Range	.046	.006	1	.000	1.047	1.035	1.059
Gender	-1.520	.107	1	.000	.219	.178	.270
Men Sex with Men	-.015	.055	1	.790	.986	.885	1.097
Sexual Orientation	.016	.017	1	.369	1.016	.982	1.051
Pregnant	-1.669	.031	1	.000	.188	.177	.200
Drug Use	-.311	.128	1	.015	.733	.570	.942

Sex While Intoxicated OR High	-.037	.133	1	.783	.964	.742	1.252
Condom Use Always	.575	.200	1	.004	1.776	1.200	2.629
Condom Use Sometimes	-.285	.192	1	.139	.752	.516	1.096
Condom Use Never	-.094	.229	1	.682	.910	.581	1.427
Condom Use with Main Partner	.293	.176	1	.097	1.340	.949	1.893
Condom Use with Other Partners	-.132	.207	1	.523	.876	.585	1.314
Sex with Anonymous Partner	.055	.174	1	.752	1.057	.752	1.485
Sex with Partner Met Via Internet	.100	.190	1	.600	1.105	.761	1.604
New Partner Within the Last 90 Days	.380	.220	1	.084	1.462	.950	2.251
Number of Sex Partners	-.014	.034	1	.682	.986	.923	1.054
Pick Up in Bar	.447	.328	1	.172	1.564	.823	2.973
Pick Up in Bath	-.050	.267	1	.853	.952	.564	1.606
HIV Self-Aware	-.220	.036	1	.000	.802	.748	.861
Paid for Sex	-.308	.186	1	.098	.735	.510	1.058
Was Paid for Sex	-.044	.180	1	.807	.957	.673	1.361
Vaginal or Anal Sex with Female	-.141	.167	1	.399	.869	.626	1.205
Oral Sex with Female	.146	.228	1	.522	1.157	.740	1.808
Unprotected Vaginal or Anal Sex with Female	.108	.218	1	.622	1.113	.726	1.707

Vaginal or Anal Sex with Male	.058	.139	1	.675	1.060	.808	1.391
Oral Sex with Male	.141	.217	1	.516	1.152	.752	1.764
Unprotected Vaginal or Anal Sex with Male	-.182	.200	1	.363	.834	.564	1.234
Vaginal or Anal Sex with Male who has Sex with Male	.077	.173	1	.659	1.080	.769	1.516
History of Prior STD	-.017	.051	1	.741	.983	.890	1.087
History of Prior STD Within Last 12 Months	-.083	.117	1	.479	.921	.732	1.158
Incarcerated Within Last 12 Months	.028	.130	1	.828	1.029	.797	1.328
Victim of Sexual Assault	-.999	.265	1	.000	.368	.219	.619
Constant	2.017	.070	1	.000	7.513		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B7

All Results of the Multiple Logistic Regression for the Southeast Region

Multiple Logistic Regression for the Southeast Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	.031	.023	1	.165	1.032	.987	1.078
Age Range	.078	.011	1	.000	1.081	1.059	1.104
Gender	.076	.256	1	.766	1.079	.653	1.782
Men Sex with Men	-.417	.124	1	.001	.659	.517	.840

Sexual Orientation	-.270	.039	1	.000	.763	.708	.823
Pregnant	-.161	.074	1	.030	.851	.736	.984
Drug Use	.122	.105	1	.245	1.130	.920	1.388
Sex While Intoxicated OR High	-.090	.139	1	.519	.914	.696	1.200
Condom Use Always	-.186	.208	1	.371	.830	.553	1.248
Condom Use Sometimes	-.120	.204	1	.559	.887	.594	1.325
Condom Use Never	-.291	.232	1	.209	.747	.474	1.178
Condom Use with Main Partner	-.036	.162	1	.825	.965	.702	1.325
Condom Use with Other Partners	.355	.237	1	.134	1.426	.896	2.267
Sex with Anonymous Partner	-.293	.174	1	.091	.746	.530	1.048
Sex with Partner Met Via Internet	.136	.175	1	.437	1.146	.813	1.616
New Partner Within the Last 90 Days	.258	.221	1	.242	1.295	.840	1.997
Number of Sex Partners	.013	.010	1	.194	1.013	.993	1.033
Pick Up in Bar	.669	.578	1	.247	1.953	.629	6.061
Pick Up in Bath	.607	.603	1	.315	1.835	.562	5.985
HIV Self-Aware	-.204	.065	1	.002	.815	.717	.927
Paid for Sex	.346	.203	1	.089	1.413	.949	2.103
Was Paid for Sex	-.431	.187	1	.021	.650	.450	.938
Vaginal or Anal Sex with Female	-.049	.193	1	.801	.952	.653	1.390
Oral Sex with Female	-.322	.198	1	.104	.725	.492	1.068

Unprotected Vaginal or Anal Sex with Female	.410	.232	1	.078	1.506	.956	2.374
Vaginal or Anal Sex with Male	-.345	.170	1	.042	.708	.508	.988
Oral Sex with Male	.247	.204	1	.226	1.280	.858	1.910
Unprotected Vaginal or Anal Sex with Male	.092	.200	1	.647	1.096	.740	1.623
Vaginal or Anal Sex with Male who has Sex with Male	-.152	.149	1	.309	.859	.642	1.151
History of Prior STD	-.066	.095	1	.486	.936	.777	1.128
History of Prior STD Within Last 12 Months	-.055	.122	1	.654	.947	.745	1.203
Incarcerated Within Last 12 Months	.257	.124	1	.038	1.293	1.014	1.648
Victim of Sexual Assault	-.592	.268	1	.027	.553	.327	.936
Constant	-1.085	.200	1	.000	.338		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B8

All Results of the Multiple Logistic Regression for the Southwest Region

Multiple Logistic Regression for the Southwest Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	.032	.038	1	.411	1.032	.957	1.113
Age Range	.048	.020	1	.017	1.049	1.009	1.092
Gender	-.351	.562	1	.532	.704	.234	2.119

Men Sex with Men	-.408	.267	1	.126	.665	.394	1.122
Sexual Orientation	-.270	.070	1	.000	.763	.665	.875
Pregnant	-.719	.187	1	.000	.487	.338	.703
Drug Use	-.028	.201	1	.890	.973	.656	1.442
Sex While Intoxicated OR High	-.021	.222	1	.924	.979	.634	1.512
Condom Use Always	.456	.272	1	.093	1.578	.927	2.687
Condom Use Sometimes	.145	.325	1	.656	1.156	.611	2.184
Condom Use Never	-.083	.323	1	.796	.920	.489	1.732
Condom Use with Main Partner	.080	.202	1	.693	1.083	.729	1.608
Condom Use with Other Partners	-.097	.322	1	.764	.908	.483	1.707
Sex with Anonymous Partner	-.315	.254	1	.214	.730	.444	1.200
Sex with Partner Met Via Internet	-.119	.296	1	.687	.887	.496	1.586
New Partner Within the Last 90 Days	-.104	.285	1	.715	.901	.515	1.575
Number of Sex Partners	-.105	.116	1	.363	.900	.717	1.129
Pick Up in Bar	.147	.445	1	.741	1.159	.484	2.773
Pick Up in Bath	-.274	.417	1	.511	.760	.335	1.722
HIV Self-Aware	.007	.098	1	.944	1.007	.831	1.221
Paid for Sex	-.214	.342	1	.532	.808	.413	1.579
Was Paid for Sex	.313	.296	1	.291	1.367	.765	2.444
Vaginal or Anal Sex with Female	.043	.259	1	.868	1.044	.628	1.735

Oral Sex with Female	.881	.388	1	.023	2.412	1.128	5.161
Unprotected Vaginal or Anal Sex with Female	-.137	.260	1	.597	.872	.524	1.450
Vaginal or Anal Sex with Male	-.271	.270	1	.317	.763	.449	1.296
Oral Sex with Male	.087	.342	1	.800	1.091	.557	2.134
Unprotected Vaginal or Anal Sex with Male	.466	.346	1	.178	1.593	.809	3.138
Vaginal or Anal Sex with Male who has Sex with Male	-.348	.253	1	.169	.706	.430	1.159
History of Prior STD	-.149	.159	1	.350	.862	.631	1.177
History of Prior STD Within Last 12 Months	-.484	.244	1	.047	.616	.382	.994
Incarcerated Within Last 12 Months	.317	.232	1	.171	1.373	.872	2.163
Victim of Sexual Assault	.007	.280	1	.981	1.007	.581	1.744
Constant	-.564	.470	1	.230	.569		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.

Table B9

All Results of the Multiple Logistic Regression for the South Region

Multiple Logistic Regression for the South Region							
						95% C.I.for EXP(B)	
	B	S.E.	df	Sig.	Exp(B)	Lower	Upper
Race/Ethnicity	-.140	.011	1	.000	.869	.851	.888

Age Range	.049	.005	1	.000	1.050	1.040	1.060
Gender	-2.105	.083	1	.000	.122	.103	.143
Men Sex with Men	.397	.040	1	.000	1.487	1.375	1.609
Sexual Orientation	.149	.014	1	.000	1.160	1.130	1.192
Pregnant	-1.375	.033	1	.000	.253	.237	.270
Drug Use	-.011	.105	1	.915	.989	.806	1.214
Sex While Intoxicated OR High	-.072	.124	1	.562	.931	.730	1.186
Condom Use Always	-.214	.173	1	.217	.807	.575	1.134
Condom Use Sometimes	.045	.185	1	.808	1.046	.727	1.505
Condom Use Never	.064	.168	1	.703	1.066	.767	1.482
Condom Use with Main Partner	-.131	.166	1	.431	.878	.634	1.214
Condom Use with Other Partners	-.031	.180	1	.863	.970	.681	1.379
Sex with Anonymous Partner	.038	.144	1	.790	1.039	.784	1.377
Sex with Partner Met Via Internet	.113	.156	1	.467	1.120	.825	1.519
New Partner Within the Last 90 Days	-.019	.172	1	.912	.981	.700	1.375
Number of Sex Partners	-.003	.007	1	.638	.997	.983	1.010
Pick Up in Bar	-.144	.296	1	.626	.866	.484	1.547
Pick Up in Bath	.389	.300	1	.195	1.476	.819	2.657
HIV Self-Aware	-.151	.027	1	.000	.860	.815	.907
Paid for Sex	.333	.184	1	.071	1.395	.973	2.000
Was Paid for Sex	-.433	.157	1	.006	.649	.476	.883

Vaginal or Anal Sex with Female	-.277	.143	1	.052	.758	.573	1.002
Oral Sex with Female	-.197	.161	1	.222	.822	.599	1.126
Unprotected Vaginal or Anal Sex with Female	.112	.162	1	.490	1.118	.814	1.537
Vaginal or Anal Sex with Male	.128	.119	1	.283	1.136	.900	1.434
Oral Sex with Male	.243	.187	1	.192	1.276	.885	1.839
Unprotected Vaginal or Anal Sex with Male	-.224	.161	1	.163	.799	.583	1.095
Vaginal or Anal Sex with Male who has Sex with Male	-.148	.132	1	.262	.862	.666	1.117
History of Prior STD	-.049	.048	1	.302	.952	.867	1.045
History of Prior STD Within Last 12 Months	-.030	.108	1	.782	.971	.786	1.198
Incarcerated Within Last 12 Months	-.072	.116	1	.536	.931	.742	1.168
Victim of Sexual Assault	.206	.137	1	.132	1.228	.940	1.606
Constant	2.017	.070	1	.000	7.514		

Note: Table created from data provided by FDOH STARS system and using IBM SPSS version 25.