Spring 5-16-2014

Risk Factors For Sexually Transmitted Bacterial and Viral Diseases: Analysis of 2007-2010 NHANES Data

Marissa Gray

Risk Factors For Sexually Transmitted Bacterial and Viral Diseases: Analysis of 2007-2010 NHANES Data

By:

Marissa R. Gray

B.S., Georgia Southern University, 2010

A Thesis Submitted to the Graduate Faculty

Of Georgia State University in Partial

Fulfillment

Of the

Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA

Abstract

Background: This study examines factors that are more associated with risk of sexually transmitted bacterial and viral diseases in a representative sample of American adults.

Methods: This is a cross sectional study using secondary data from the 2007-2010 National Health and Nutritional Examination Survey (NHANES) data. Statistical Package for the Social Sciences (SPSS) is the software used in analysis of descriptive data and logistic regression models. Univariate logistic regression analyses were performed to determine associations between risk factors and sexually transmitted diseases. Multivariate logistic regression analyses were performed to determine associations between risk factors and sexually transmitted diseases while controlling for confounders. A forward stepwise logistic regression analysis was to determine the best predictors of each type of sexually transmitted diseases.

Results: The sample size for the study population is n=9,216. There were four observed risk factors that were significantly associated with both bacterial sexually transmitted diseases as well as viral sexually transmitted diseases at the 0.05 level of probability. Lack of health insurance was associated with 1.66 increased odds of sexually transmitted viral disease compared to 1.55 increased odds seen in sexually transmitted bacterial disease. History of birth control was associated with 2.61 and 1.66 increased odds in sexually transmitted bacterial disease and sexually transmitted viral disease, respectively. Having first sexual encounter in adulthood was associated with 3.01 increased odds in sexually transmitted bacterial disease and 1.72 times increased odds in sexually transmitted viral diseases. Multiple sexual partners was associated with decreased odds in both sexually transmitted bacterial and viral sexually transmitted diseases.

Conclusions: The results of this study indicating differences in factors that are associated with sexually transmitted bacteria diseases and sexually transmitted viral diseases provide evidence for developing public health intervention that is based on type of infection. Public health intervention programs that address sex education, effect of IV drug use, the importance of health insurance, the use of birth control, circumcision, and smoking cessation may help to curb the prevalence of both sexually transmitted bacterial and viral infections in at-risk groups.

Risk Factors For Sexually Transmitted Bacterial and Viral Diseases: Analysis of 2007-2010 NHANES Data

By: Marissa R. Gray

Approved:

_____
Dr. Ike Okosun PhD. MPH
Committee Chair

_____
Professor John Steward
Faculty Member

_____
Date

Author's Statement Page

In presenting this thesis as a partial fulfillment of the requirements for an advanced degree from Georgia State University, I agree that the Library of the University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote from, to copy from, or to publish this thesis may be granted by the author or, in her absence, by the professor under whose direction it was written, or in in his/her absence, by the Associate Dean, School of Public Health. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation which involves potential financial gain will not be allowed without written permission of the author.

_____

Signature of Author

ACKNOWLEDGEMENTS

I would like to thank my committee members Dr. Okosun and Professor Stewart for all of their guidance and support with the completion of my thesis as well as throughout the Masters of Public Health Program. I would like to acknowledge the faculty and staff at Georgia State University for sharing their knowledge and wisdom. I would also like to thank my family and friends for their support not only through this program but in life itself. Lastly a special thanks to my son C.J. who has been my inspiration and motivation for completing this degree and it is all for him.

Notice to Borrowers Page

All theses deposited in the Georgia State University Library must be used in accordance with the stipulations prescribed by the author in the preceding statement.

The author of this thesis is:
Students Name: Marissa Gray
Street Address: 5108 Victor Trail
City, State, and Zip Code: Norcross, GA 30071

The Chair of the committee for this thesis is:
Professor's Name: Dr. Ike Okosun, PhD. MPH
Department: Epidemiology
College: School of Public Health

Georgia State University
P.O. Box 3995
Atlanta, Georgia 30302-3995

Users of this thesis who not regularly enrolled as students at Georgia State University are required to attest acceptance of the preceding stipulation by signing below. Libraries borrowing this thesis for the use of their patrons are required to see that each user records here the information requested.

NAME OF USER	ADDRESS	DATE	TYPE OF USE (EXAMINATION ONLY OR COPY)

Marissa R. Gray

5108 Victor Trail
Norcross, GA 30071
(860) 897-8840
Marissagray4@gmail.com

EDUCATION

Georgia State University, Atlanta, GA *Anticipated: May 2014*
Masters of Public Health
Concentration: Epidemiology

Georgia Southern University, Statesboro, GA *Dec. 2010*
Bachelor of Science in Community Health
Minor: Psychology

CAREER PROFILE:

Public health student/professional with 5+ years' experience in the community health field. Excellent in data analytical processes, epidemiology and organization skills, with demonstrated abilities to learn quickly. Ability to conduct independent research, develop and gather data, effective with oral and written communication, dedicated, and detailed oriented, with ability to successfully adapt and learn new health field processes. Excellent team player as well as self-motivated individual.

WORK EXPERIENCE

Peachford Hospital, Atlanta, GA **June 2011-present**
Mental Health Assistant

- Provides direct supervision to patients with psychiatric disorders and chemical dependence by monitoring patients to ensure patient safety
- Plan, prepare and facilitate psychosocial groups related to treatment
- Participate in treatment planning by identifying patient's problems and needs and assist in learning new coping skills and develop a post discharge plan.

AID Atlanta, Atlanta, GA **Jan. 2013-May 2013**
Intern

- Facilitated HIV/AIDS intervention groups targeted to at risk populations to promote safe sex and HIV/AIDS awareness and education
- Developed community partnerships to form a liaison between AID Atlanta and other organizations such as universities and other non-profit agencies to spread HIV/AIDS awareness
- Assisted in HIV testing events and helped with confidential HIV testing and posttest counseling
- Entered data from testing events into a spread sheet that was used for data analysis

Pineland Women's Services, Statesboro, GA **Sept. 2009-Dec. 2010**
Mental Health Worker

- Administered medication to ensure medication compliance among clients
- Facilitated groups related to drug and alcohol chemical dependency and transported clients to daily AA and NA meetings to assist in recovery and sober living
- Administered random drug screens to clients to ensure sobriety

Webster Bank **2007 – 2009**
Teller

- Calculate daily transactions using computers, calculators, or adding machines
- Balance currency, coin, and checks in cash drawers at ends of shifts
- Receive checks and cash for deposit, verify amounts, and check accuracy of deposit slips
- Enter customers' transactions into computers in order to record transactions and issue computer-generated receipts
- Count currency, coins, and checks received either by hand or using counting machine to prepare them for deposit

VOLUNTEER EXPERIENCE

- **AID Atlanta, Atlanta, GA** **May 2013- present**

- **Bulloch County Health Department, Statesboro, GA August 2010-Dec. 2010**

LICENSES

- CPR, AED and First Aid certified by the American Red Cross

Table of Contents

LIST OF TABLES

CHAPTER I
INTRODUCTION

1.1 Background

Sexually transmitted diseases are a worldwide public health concern. Every person who is sexually active is at risk for contracting a sexually transmitted disease. According to the Centers for Disease Control and Prevention, 1,422,976 cases of Chlamydia and 334,829 cases of gonorrhea were reported in the United States in 2012 (CDC, 2012). For sexually transmitted viral diseases, the Centers for Disease Control and Prevention estimate that there are 776,000 new herpes infections and 360,000 new genital warts infections annually (CDC, 2012). Recent data from CDC also shows that the rates of chlamydia, gonorrhea, herpes and genital warts infection have increased from the observed rates from previous years. This is concerning because despite all the prevention methods available, including safe sex practices and educational programs, rates of infection from sexually transmitted disease have not descried.

The National Institutes of Health describe a viral infection as a complex process in which viral molecule multiply when they invade the cells of their host (NIH, 2010). Since a virus uses the cells of the host to multiply it will stay in the body forever. Although viral infections cannot be cured they can however be managed and controlled. Once a person is diagnosed with a sexually transmitted viral disease the person will always have it, even if the person do not experience a noticeable outbreak, the virus does remain dormant in the body.

The National Institutes of Health describe bacterial infection as a process in which one cell bacterial organism that cling to the body of their host (NIH, 2010). Since the bacterial molecules adhere to and feed from the host, bacteria do not invade and multiply as seen in viral infections, because of this reason bacterial infection are curable. Bacteria-induced sexually transmitted infections can be cured with antibiotics. However, sexually transmitted bacterial diseases are still a public health concern because of bacteria ubiquity. Understanding the biology and epidemiology of how viral and bacterial induced sexually transmitted diseases affect the body is important for prevention efforts.

1.2 Purpose of the study

We hypothesize that because of differences in sexually transmitted bacterial diseases and sexually transmitted viral diseases affect the body differently, factors that are associated with their infection will vary. Therefore, the purpose of this study is to examine risk factors that are associated with contracting sexually transmitted bacterial diseases and sexually transmitted viral diseases in a representative sample of Americans. Identifying risk factors that are associated with increased infection for sexually transmitted diseases are critical for crafting prevention programs to lower incidence and prevalence sexually transmitted diseases.

1.3 Research Questions

1. What risk factors are more associated with sexually transmitted bacterial diseases?
2. What risk factors are more associated with sexually transmitted viral diseases?

3. What are the most predictive risk factors for a sexually transmitted bacterial disease?
4. What are the most predictive risk factors for a sexually transmitted viral disease?

CHAPTER II

REVIEW OF THE LITERATURE

The literature review is focused on examining risk factors that have been found to be associated with increase susceptibility for sexually transmitted diseases. Studies that discuss the distribution of sexually transmitted diseases are also noted. Finally, the effect of different risk factors related to sexually transmitted bacterial diseases and sexually transmitted viral diseases are discussed.

2.1 Alcohol

Alcohol is a known risk factor for sexually transmitted diseases because alcohol lowers a person's inhibitions, which may influence their sexual behavior, and thus a compromise safe sex practices. Many studies have investigated the association between alcohol use and sexually transmitted diseases, particularly in high risk populations such as female and male sex workers, drug users and long distant truck drivers (Pandey et al., 2012). There was no research that found alcohol to be more associated with contracting sexually transmitted viral disease or a sexually transmitted bacterial disease. Age of first alcohol consumption was a significant factor for chlamydia infections (McMunn et al., 2007). This could be relevant because early onset of drinking could be a pattern for subsequent heavy alcohol use. Another study found that the amount of alcohol consumed on a heavy night of binge drinking is associated with chlamydial infections (McMunn et al., 2007). More specifically, McMunn et al, 2017, found that women who have been treated for chlamydial infections consumed an average of 15 units of alcohol on a night of heavy drinking compared to women who were not treated for chlamydial infection who consumed an average of 12 units of

alcohol (McMunn et al., 2007). Although there is only a difference of an average of 3 units of alcohol, this could indicate that after the 12th units of alcohol, inhibitions are lowered. This may suggest that more than 12^{t} units of alcohol consumption is associated with poor decision making regarding practicing safe sex. “Alcohol can influence cognitive, neurological and psychosocial development which can lead to inhibited judgment, increased impulsivity and involvement in high-risk behaviors and environments” (Khan et al., 2012). In particular, alcohol use has been associated with increased sexual partners in African American adolescents compared to white adolescents, which increases risk of contracting a sexually transmitted disease (Khan et al., 2012).

2.2 Smoking

Smoking is a common risk factor for many diseases and many times put people at a significantly higher risk for developing a disease. There has been a lot of research investigating smoking, its relationship to reproductive health as well as sexually transmitted diseases. More research is starting to show how cigarette smoking increases risk of sexually transmitted infections due to the structural modification in the lung and immunological changes (Berg et al., 2012). One study examined smoking as a potential risk factor for contracting a sexually transmitted disease and found a positive association between smoking and sexually transmitted diseases in African American adolescent females (Berg et al., 2012). Although the study was specific to adolescent African American women, the finding is significant because it serves as the basis recommending more research efforts in order to understand the true relationship between smoking and sexually transmitted diseases across race/ethnicity. Smokers are

also less likely than nonsmokers to use contraceptives (Wolf et al. 2000). Women smokers tend to indulge in sexual practices at much lower age and have higher number of sexual partners compared to non-smokers (Wolf et al. 2000). When smoking was studied as a potential risk factor for human papillomavirus, the prevalence of the virus was found to be associated with increased number of cigarettes smoked (Wolf et al. 2000). In comparing association of smoking with herpes simplex virus, the authors also and found that within people who had herpes simplex virus, smokers experienced more outbreaks compared with nonsmokers (Wolf et al. 2000). However, the study did not look at the relationship between smokers and nonsmokers with herpes simplex virus positive results and herpes simplex virus negative results.

2.3 Race/Ethnicity

Race is epidemiologic variable that is often examined when investigating diseases. Understanding the role of race is critical in determining the type of intervention that is culturally appropriate and most effective for a particular race. In the United States, research has shown that African Americans as well as Hispanics have disproportionally higher rates of sexually transmitted diseases compared to Whites (Adams et al., 2013) (Majola & Everett, 2912). It is important to identify what is causing the disproportionate rates of infection. Is it strictly driven by behavior or is there something genetically that would make an African American or Hispanic person more susceptible to becoming infected with a sexually transmitted disease? In terms of gonorrhea one study found that African Americans had the highest rates of gonorrhea infection at all poverty levels and the rate of infection was between 6.4 and 18.3 times higher in African Americans than other races (CDC, 2014). Another study found that

African Americans were 11.4 times more likely to be infected with chlamydia (Hipwell et al., 2012). The same pattern of disproportionate racial difference is also found in herpes simplex virus where African American and Hispanics have much higher rates of infection compared to their white counterparts (McQuillian et al., 2004). Research has shown that no matter what type of sexually transmitted disease, be it a viral infection or a bacterial infection, African Americans and Hispanics tend to have a higher rate of infection across the board. The theories as to why this is the case is not clear and requires more research to properly determine incidence and prevalence rates of the diseases as well as on the intervention programs and if they are effective in those communities. One study found that African American adolescent girls are less likely to engage in high risk sexual behaviors than their white adolescent peers in spite of their higher rates of sexually transmitted diseases (Hipwell et al., 2011). Similarity, another study found that African American's showed significantly higher rates of condom use compared to Whites and Hispanics (Mojola et al., 2012). The data supports the fact that African Americans are practicing safer sex however they still have the highest rates of sexually transmitted diseases. Age at first sexual encounter could play a role in the disproportionate rates of sexually transmitted diseases given that African Americans have their first sexual encounter earlier than whites and Hispanics (Dariotis et al., 2011). Another variable that could influence the disproportionate rate of infection in African Americans is that African Americans have more sexual partners and are more likely to have more than one sexual partner at a time (Adams et al., 2013). Although African Americans are more likely to use condoms, they are still participating in sexual activities and sexual patterns that would make it more likely for them to contract a sexually

transmitted disease. “The elimination of racial and ethnic health disparities is a major U.S. public health goal (Dariotis et al., 2011)”. This is especially important when discussing preventable diseases such as sexually transmitted diseases.

2.4 Circumcision

In the United States circumcision is a very common practice, however only about one quarter of men worldwide are circumcised (Jozkowski et al., 2010). The impact on a man’s sexual health in terms of circumcision is poorly understood. Several studies supporting the general role of circumcision do not support circumcision as a risk factor for sexually transmitted diseases. Studies have found that circumcision may reduce the rates of HIV infection in both heterosexual males and females, however there are conflicting studies that report if circumcision can reduce other sexually transmitted diseases (Dickson et al., 2008). One study found that circumcised men are at lower risk of human papillomavirus and herpes simplex virus (Pando et al., 2013). A contrary study found that lack of circumcision increased genital warts in men (Moretlowe et al., 2013). Larke found that herpes simplex virus was 30% lower in circumcised men than in uncircumcised men and that circumcised men are half as likely to be infected with human papillomavirus (Larke, 2010). Larke goes on further to explain how the foreskin of uncircumcised men can make it easier for them to contract sexually transmitted diseases. The inner mucosal surface of the foreskin is more susceptible to abrasions which would make it easier for the disease to enter the body and the environment under the foreskin is an ideal breeding ground for the replication of the pathogen due to its warm and moist nature (Larke, 2010). All of the above diseases where circumcision is

shown to reduce the risk of infection have been sexually transmitted viral diseases. There are few studies that explore the relationship between circumcision and sexually transmitted bacterial diseases. One study found that circumcision did not influence the risk of syphilis (Bowers et al., 2009). Even if circumcision only influences sexually transmitted viral diseases it is a huge prevention strategy that is not widely practiced considering the large percentage of males who are uncircumcised, especially in developing countries where HIV rates are higher.

2.5 Pregnancy/Birth Control

Pregnancy is a risk factor often examined when looking at sexually transmitted diseases. Pregnancy can predispose women to infection, including sexually transmitted diseases because the immune system is generally suppressed to assure tolerance of the fetus (Sappenfield et al., 3.2). Anything to compromise the immune system is likely to make a person more susceptible to diseases. One study found that HPV was nearly doubled in pregnant women (Singhal et al., 2009). It was also found that “pregnancy represented the second largest group of adults with herpes simplex virus” (Sappenfield et al., 3.2). Being the second largest group with herpes simplex virus, it is possible that a woman already had the virus however did not experience a severe breakout until they were pregnant which could impact awareness. Another study specifically examined women who were already aware of their herpes virus and found that 87.3% of the women had type 1 herpes or oral compared with 15.1% of women who had type 2 or genital herpes (Arama et al., 2008). Awareness programs of how pregnancy can make

you more susceptible to diseases, especially sexually transmitted diseases need to be created.

Birth control has also been shown in some studies as a risk factor for sexually transmitted diseases with the thought that it makes a person less likely to practice condom use while taking birth control. Many women choose their birth control based on their expectations, if they are specifically taking birth control to prevent unintended pregnancy, then they may be less likely to practice condom use as well (Delavade, 2008). It is important to reemphasize that birth control does not prevent sexually transmitted diseases and that condom use should still be practiced. Another study focused on family influence on condom use as well as birth control use and found that African American adolescents had the strongest disapproving parental attitudes but were more likely to use condoms, however were also more likely to report a sexually transmitted disease (Kao, Manczak, 2013). This is in accordance with previous studies that show the disproportionate rates of sexually transmitted diseases in African Americans.

One study also found that syphilis in pregnant women is associated with increased the rate of HIV infection (Yahya-Malima et al., 2008). This is important because majority of studies are restricted to viral diseases such as herpes and human papillomavirus rather than bacterial infection. Pregnancy should be a time where a lot of information about sexually transmitted diseases is given due to the serious negative affects it could have on the unborn child. Awareness and education programs that are targeted specifically toward pregnant women are greatly needed, especially in developing countries.

2.6 Gender

There are many factors that are associated with gender differences in both sexually transmitted bacterial and sexually transmitted viral diseases. One study found that black men had higher rates in gonorrhea than black women (Springer et al., 2010). Another study found that white men had higher rates of syphilis than white women (Owusu-Edusei et al., 2013). Adult men had higher rates of sexually transmitted bacterial diseases in both studies. However a study was done on adolescents and found that adolescent girls are more likely than adolescent boys to contract chlamydia, gonorrhea and HIV (Hipwell, 2012). In Miskulin 2010 study it found that women were also more likely to have herpes simplex virus compared to men (Miskulin et al., 2010). Age seems to be associated to how sexually transmitted diseases are related to gender. Research has found that the differences in gender roles could be related to initiation of condom use in which females are less likely to initiate condom use than males which increases risk of exposure (Pflieger et al., 2013).

2.7 Co-infections/Recurrent infections

Having a history of sexually transmitted disease is potential risk factor for contracting another sexually transmitted disease, even if the disease is curable. One study examined herpes simplex virus and HIV and found that herpes was more prevalent in HIV positive women compared with HIV negative women (Remis et al. 2013). However, the study did not examine if the HIV women were positive for herpes simplex virus before they were found positive for HIV infection. Another study also found that having recurrent lesions with Herpes virus can act as an easier source of

entry for HIV infection (Lupi, 2011). Having a sexually transmitted bacterial disease such as gonorrhea or chlamydia is strongly associated with bacterial vaginosis (Gallo et al., 2011). When examining people who've had recurrent sexually transmitted disease a study was investigating their perceived risk and found that people who have had more than one sexual transmitted disease perceived their risk of susceptibility for another sexually transmitted disease as low (Kaestle, 20011). Perception of risk is what many of these articles have in common and people who have had recurrent sexually transmitted diseases and their perception of risk are not equal. Education programs targeted to individuals who tested positive for a sexually transmitted disease should be adopted so that people know they are at a greater risk for having another sexually transmitted disease.

2.8 IV Drug use

Approximately 80% of HIV-infected heterosexual adults who do not inject drugs, are infected through sexual contact with HIV-infected intravenous drug users (Rosengard et al., 2006). The study by Rosengard validates how IV drug use affects the users as well as their sexual partners. Another study found that intravenous drug users that injected methamphetamine were more likely to report a sexually transmitted disease than non IV drug users (Cheng et al., 2010). Khan found that IV drug users were 2.6 times more likely to contract a sexually transmitted disease (Khan et al., 2013). The research did not differentiate between the types of sexually transmitted disease. One article explores the explanation behind the higher rates of sexually transmitted diseases in intravenous drug users to be related to "elevations in numbers of sex partnerships and sex trade, decreases in condom use, and engagement in high-risk

sexual networks in which there is elevated risk of links to STI-infected sexual partners" (Khan et al., 2013).

CHAPTER III
METHODS AND PROCEDURES

3.1 Data Source

The secondary data used in this study is from the National Health and Nutritional Examination Survey (NHANES). NHANES is a major program by the National Center of Health Statistics of the Centers for Disease Control and Prevention that provide health statistics for the United States. Adults and children are assessed in the survey through questionnaires, interviews and physical examinations (CDC, 2014). The NHANES studies began in the early 1960s and in 1999 became a continuous program that has a changing focus to meet evolving needs (CDC, 2014). Data from the combined NHANES 2007-2010 demographics and questionnaire files were used for this cross sectional study.

3.2 Inclusion and Exclusion Criteria

The analysis was limited to respondents aged 13-59 in the NHANES 2007-2008 and 2009-2010 data sets. Respondents were excluded from the study that were 12 years and younger or 60 years and older because there were no cases of either sexually transmitted viral disease or sexually transmitted bacterial disease in those age categories. The resulting study sample n=9216.

3.3 Variables

Demographics

The demographic variables that were chosen for this study were age, race, health insurance and marital status. Race was recoded into four different categories. “1” represents non-Hispanic whites, “2” represents non-Hispanic black, “3” represents Hispanics including Mexican Americans and “4” represents being other which also

included multi race. Marital status was defined as 1 being married, “2” representing widowed, “3” representing divorced, “4” representing separated, and “5” representing never married. Gender was coded as “1” representing males and “2” representing females.

Sexual Transmitted Disease

There were two categories of sexual transmitted disease that were used for this study which were sexually transmitted bacterial disease and sexually transmitted viral disease. Classification of a sexually transmitted bacterial disease was based on participants answering “1” which was yes for either “doctor ever told you had gonorrhea” or “doctor ever told you had chlamydia”. Classification of a sexually transmitted viral disease was based off participants answering “1” which was yes for either “Doctor ever told you had herpes” or “Doctor ever told you had genital warts”. These two variables were used as the two dependent variables for the study.

Sexual behavior/Reproductive Health

Based on the number of sexual partners in the previous year, two categories were created. If participants had 0 or 1 sexual partner in the last year they were defined as none or single sexual partner and those who had two or more sexual partners were defined as having multiple sexual partners. Age when first sexual encounter occurred was also examined and three categories derived from that. Participants who had their first sexual encounter at age 12 or younger were coded as “preteen”, participants who reported first sexual encounter between the ages 13-18 were coded “adolescent” and participants who reported first sexual encounter over the age of 18 were coded “adult”. Pregnancy was defined as answering yes coded as 1 and no coded as 2 for the

following question “have you ever been pregnant”. Lastly in the variable of birth control, respondents who answered yes were coded as 1 and those who answered no were coded as 2 for the question “Have you ever taken any form of birth control” which included birth control pills, IUD or Depo-Provera shot. Condom use was not included in this study due to the nature of the study being focused on risk factors that could potentially increase rates of sexually transmitted diseases and not adherence with condom use.

Behavior

Smoking was defined as answering “yes” or “1” to the question “have you smoked at least 100 cigarettes in lifetime”. Heavy drinking was defined as answering “yes” or “1” to the question “Have you ever had 5 or more drinks every day”. IV drug users were defined as answering “yes” or “1” to the question “Have you ever used a needle to inject drugs”. Respondents who answered yes were coded as 1 and those who answered no were coded as 2 when asked “Are you covered by health insurance?”

3.4 Statistical Procedure

Statistical Package for the Social Sciences (SPSS) version 21 was used to prepare data as well as analyze data and run statistical tests. Descriptive statistics were derived from the demographic variables using SPSS. Prevalence of sexually transmitted bacterial diseases and sexually transmitted viral diseases were derived from the data. Univariate logistic regression analyses were performed on sexually transmitted viral diseases as well as sexually transmitted bacterial diseases to determine their association with risk factors, which included race, gender, heavy drinking, IV drug users, health insurance, pregnancy, birth control, number of sexual partners, circumcision,

smoking and age of first sexual encounter. Multivariate logistic regression analysis was used to determine association of selected with each dependent variable (sexually transmitted bacterial diseases and sexually transmitted viral diseases) while controlling for confounders. A forward stepwise logistic regression analysis was performed on each dependent variable to determine which risk factors were the strongest predictors for each disease.

CHAPTER IV
RESULTS

4.1 Descriptive Statistics

The sample size for the study population is 9,216. The demographic characteristics of the respondents of the study that include race, gender, age and marital status are included in Table 1. The majority of the respondents were non-Hispanic Whites which consisted of 41.6%. In regards to marital status 55.7% of respondents were married.

Table 1: Demographic Characteristics of Study Population (n=9216)

Variable	n	%	Bacterial STD	Viral STD
Race				
White	3836	41.6%	18	223
Black	1909	20.7%	46	108
Hispanic	2972	32.2%	18	88
Other	499	5.4%	6	15
Gender				
Males	4545	49.3%	37	140
Females	4671	50.7%	51	294
Age				
13-19	1381	15.0%	6	4
20-29	1920	20.8%	51	77
30-39	2023	22.0%	13	121
40-49	2038	22.1%	11	134
50-59	1854	20.1%	7	98
Marital Status				
Married	3919	55.7%	13	179
Widowed	114	1.6%	1	9
Divorced	819	11.6%	7	69
Separated	316	4.5%	2	25
Never Married	1868	26.6%	43	10

4.2 Sexually Transmitted Bacterial Diseases

The results of univariate logistic regression analyses to determine an association between each of the selected independent variables with sexually transmitted bacterial diseases are shown in Table 2. As shown, race, and increased number of sexual partners were associated with decreased odds of sexually transmitted bacterial disease. Backs (OR=0.67; 95% CI=0.09-0.28) and subjects of other racial groups (OR=0.30; 95% CI=0.12-0.76) had much decreased odds of sexually transmitted bacterial infection compared with Whites. Being of Hispanic race/ethnicity was not significantly associated with sexually transmitted bacterial infection. Compared with subjects with 0 or 1 sexual partners, subjects with histories of 2 or more sexual partners presented with decreased odds (OR=0.16; 95% CI=0.11-0.25) of sexually transmitted bacterial infection. Lack of health insurance (OR=1.54; 95% CI=1.01-2.36), birth control use (OR=2.51; 95% CI=1.06-6.45), and greater than 18 years of sexual encounter (OR=3.01; 95% CI=1.78-7.72), were each associated with increased odds of sexually transmitted bacterial infection.

For the multivariate analysis (Table 2), and similar to what was observed in the univariate models, being of Black racial/ethnic group (OR=0.11; 95% CI=0.02-0.57) was associated with decreased odds of sexually transmitted bacterial infection, controlling for other independent variable. However, birth control use (OR=3.10; 95% CI=1.11-8.69) was associated with increased odds of sexually transmitted bacterial infection, controlling for other independent variable.

Table 2: Univariate Analysis of Association of Selected Independent Variables With Sexually Transmitted Bacterial Disease

Variable	n	OR	95% CI	p-Value
Race				
White	18	Referent		
Black	46	0.16	(0.09-0.28)	<.001
Hispanic	18	0.67	(0.35-1.29)	.231
Other	6	0.30	(0.12-0.76)	.011
Gender				
Males	37	Referent		
Females	51	0.76	(0.50-1.17)	.213
Alcohol	4	0.61	(0.22-1.75)	.361
IV Drug Users	3	0.66	(0.24-2.50)	.663
Health Insurance				
Yes	51	Referent		
No	37	1.54	(1.01-2.36)	.047
Pregnancy	15	2.03	(0.73-5.64)	.175
Birth Control	12	2.61	(1.06-6.45)	.037
Number of sexual Partners				
0-1	38	Referent		
2≥	49	0.16	(0.11-0.25)	<.001
Circumcision	25	0.73	(0.46-1.16)	.729
Smoking	43	1.30	(0.84-2.02)	.235
Age at Fist sexual Encounter				
<13	7	Referent		
13-18	69	1.43	(0.65-3.13)	.375
>18	18	3.01	(1.78-7.72)	.021

Table 3: Multivariate Analysis of Association of Selected Independent Variables With Sexually Transmitted Bacterial Disease

Variable	OR	95% CI	p-value
Race			
White	Referent		
Black	0.11	(0.02-.057)	.009
Hispanic	0.29	(0.05-1.70)	.168
Other	0.13	(0.10-1.66)	.116
IV Drug Users	9.74	(0.99-95.6)	.051
Health Insurance			
Yes	Referent		
No	0.81	(0.27-2.45)	.710
Pregnancy	1.69	(0.51-5.64)	.393
Birth Control	3.10	(1.11-8.69)	.031
Number of sexual Partners			
0-1	Referent		
2≥	0.35	(0.12-0.99)	.049
Smoking	1.08	(0.39-3.01)	.877
Age at Fist sexual Encounter			
<13	Referent		
13-18	2.49	(0.52-11.97)	.255
>18	6.81	(0.82-56.56)	.076

4.3 Sexually Transmitted Viral Diseases

The results of univariate logistic regression analyses to determine an association between each of the selected independent variables with sexually transmitted viral diseases are shown in Table 4. As shown, female gender (OR=0.48; 95% CI=0.39-0.59) and having 2 or more sexual partners (OR=0.74; 95% CI=0.58-0.94) were each associated with decreased odds of sexually transmitted viral disease. Being of Hispanic race (OR=1.76; 95% CI=1.37-2.26), Intravenous drug use (OR=2.09; 95% CI=1.32-3.31), lack of health insurance, (OR=1.61; 95% CI=1.28-2.03), birth control use (OR=1.66; 95% CI=1.03-2.68), circumcision (OR=1.24; 95% CI=1.02-1.51), smoking (OR=1.24; 95% CI=1.02-1.51), and greater than 18 years of first sexual encounter

(OR=1.72; 95% CI=1.10-2.67), were associated with increased odds of sexually transmitted viral infection.

For the multivariate analysis (Table 5), being of Black racial/ethnic origin (OR=2.26; 95% CI=1.35-3.76), intravenous drug use (OR=2.58; 95% CI=1.07-6.23), and lack of health insurance (OR=1.65; 95% CI=1.01-2.67), were each associated with increased odds of sexually transmitted viral infection, after controlling for other independent variable.

Table 4: Univariate Analysis of Association of Selected Independent Variables With Sexually Transmitted Viral Disease

Variable	n	OR	95% CI	p-value
Race				
White	223	1.00	Referent	
Black	108	0.87	(0.69-1.11)	.269
Hispanic	88	1.76	(1.37-2.26)	<.001
Other	15	1.54	(0.90-2.63)	.115
Gender				
Males	140	1.00	Referent	
Females	294	0.48	(0.39-0.59)	.001
Alcohol	37	0.93	(0.64-1.34)	.700
IV Drug Users	22	2.09	(1.32-3.31)	.002
Health Insurance				
Yes	333	1.00	Referent	
No	101	1.61	(1.28-2.03)	<001
Pregnancy	136	0.59	(0.34-1.05)	.073
Birth Control	129	1.66	(1.03-2.68)	.038
Number of sexual Partners				
0-1	336	1.00	Referent	
2≥	97	0.74	(0.58-0.94)	.012
Circumcision	108	1.70	(1.35-2.11)	<.001
Smoking	219	1.24	(1.02-1.51)	.031
Age at Fist sexual Encounter				
<13	28	1.00	Referent	
13-18	320	1.24	(0.83-1.86)	.296
>18	86	1.72	(1.10-2.67)	.017

Table 5: Multivariate Analysis of Association of Selected Independent Variables With Sexually Transmitted Viral Disease

Variable	OR	95%CI	p-value
Race			
White	Referent		
Black	1.08	(0.69-1.69)	.749
Hispanic	2.26	(1.35-3.76)	.002
Other	1.55	(0.45-5.30)	.468
IV Drug Users	2.58	(1.07-6.23)	.036
Health Insurance			
Yes	Referent		
No	1.65	(1.01-2.67)	.045
Pregnancy	0.57	(0.31-1.05)	.070
Birth Control	1.43	(0.82-2.49)	.209
Number of sexual Partners			
0-1	Referent		
2≥	0.75	(0.45-1.24)	.259
Smoking	0.90	(0.61-1.34)	.604
Age at Fist sexual Encounter			
<13	Referent		
13-18	0.81	(0.31-2.15)	.673
>18	1.25	(0.43-3.62)	.680

4.4 Risk Factors of Prediction

The forward stepwise logistic regression analyses were employed to determine the best predictors sexually transmitted bacterial and viral diseases (Table 6). As shown the best predictors of sexually transmitted bacterial diseases include race/ethnicity, birth control use and the number of sexual partners. For sexually transmitted viral diseases, the corresponding variables are race/ethnicity, intravenous drug use and pregnancy.

Table 6: Results of Forward Stepwise Logistic Regression Analysis of Predictor of Sexually Transmitted Bacterial and Viral Diseases

Variable	OR	96% CI	P-value
Bacterial Diseases			
Race			
White	Referent		
Black	0.12	0.03 – 0.60	.009
Hispanic	0.35	0.07 – 1.83	.212
Others	0.15	0.01 – 1.70	.125
Birth Control	0.34	0.13 – 0.93	.036
Number of sexual Partners			
0-1	Referent		
≥2	0.30	0.13 – 0.93	.036
Viral Diseases			
Race			
White	Referent		
Black	1.05	0.70 – 1.59	.809
Hispanic	2.56	1.61 – 4.06	<.001
Others	1.22	0.47 – 3.20	.680
Intravenous Drug Use	2.83	1.22 – 6.55	.015
Pregnancy	0.55	0.31 – 0.97	.038

CHAPTER V
DISCUSSION AND CONCLUSION

5.1 Discussion of Research Questions

To answer the first research question, “What risk factors are more associated with sexually transmitted bacterial diseases?” Lack of health insurance, history of birth control use, and first sexual encounter at 18 years or older were found to be associated with increased odds of sexually transmitted bacterial diseases. However, being of non-Hispanic Black and Other racial group, and having multiple sex partners were associated with decreased odds of developing sexually transmitted bacterial diseases.

The second research question asked, “Which risk factors are more associated with sexually transmitted viral disease? Being of Hispanic descent, IV drug use, lack of health insurance, history of birth control use, circumcision, smoking and first sexual encounter at 18 years or older were associated with increased odds of sexually transmitted viral infections. However, being female and having multiple sexual partners were associated with decreased odds of sexually transmitted viral diseases. The results of the forward stepwise regression analysis showed that the best predictors of sexually transmitted bacterial infections were race, birth control use and multiple sexual partners in previous year. The corresponding variables for sexually transmitted viral infections were race, IV drug use and pregnancy.

5.2 Study Strengths and Limitations

The use of NHANES to describe factors that are associated with bacterial and viral infections is a major strength. Being national and representative in scope, NHANES

represent an excellent data source for this study. The quality control measures instituted in NHANES give an added credibility to the data. However, some limitations must be taken into account in the interpretation of results from this study. First, bias due to selection, misclassification, survey non-response and missing values for some variables cannot be ruled out. Second, as a cross-section study, directionality of the associations between selected variables and the dependent variables cannot be established. Third, several well-known risk factors for sexually transmitted diseases, such as comorbidities were not examined. These unmeasured risk factors may have significant implications on magnitude of the observed association between the selected risk factors and sexually transmitted diseases. Fourth, despite combining four years of NHANES data for this study, we observed only 88 cases of sexually transmitted bacterial diseases that are inconsistent with literature. One study found that there was under reporting of sexually transmitted diseases in adolescent females, especially gonorrhea (Niccolai, et al., 2004). Another study found that the reason for underreporting sexually transmitted diseases could be linked to recall bias and social desirability (Langhaug LF, et al., 2010). The recall bias could explain the low number of cases of reported sexually transmitted bacterial diseases. Fifth, one must be cognizant of limits of generalizability of the results from this study to other groups and other countries, as well as the limitations of statistical modeling techniques that were used.

5.3 Implications of Findings

The objective of this was to determine risk factors are more associated with sexually transmitted bacterial diseases or sexually transmitted viral diseases. There

were only four risk factors that were statistically significant in both sexually transmitted bacterial diseases and sexually transmitted viral diseases.

Lack of health insurance was significantly associated with increased odds of sexually transmitted bacterial diseases and sexually transmitted viral diseases. Subjects without health insurance were 1.61 times more likely to have a sexually transmitted bacterial disease than subjects with health insurance. The corresponding odds for sexually transmitted viral diseases was 1.54. The role of health insurance may be related to access to health. One study found that women without health insurance had less access to sexual and reproductive health and higher rates of human papillomavirus were found in this population (Cox, 2011). This study showed that women with history of birth control use had 2.61 increased odds of sexually transmitted bacterial disease than women subjects with no history of birth control use. Also, women with history of birth control use had 1.66 increased odds of sexually transmitted viral disease than women subjects with no history of birth control. The results imply that women who have history of birth control use are more susceptible to sexually transmitted bacterial diseases. According to Delavade, women choose their birth control based on their expectations. if they are specifically taking birth control to prevent unintended pregnancy, they may be less likely to practice condom use as well (Delavade, 2008)..

Subjects who have had multiple sexual partners were at 0.16 and 0.74 decreased odds of having both sexually transmitted bacterial disease as well as sexually transmitted viral disease, respectively, than having a single or no sexual partners in the previous year. This protective role of single or no sexual partners is inconsistent with the literature. Respondent reporting bias may explain this.

Lastly when age at first sexual encounter was examined, subjects who had first sexual encounter in adulthood were 3.01 times more likely to have a sexually transmitted bacterial disease than subjects with much earlier age of first sexual encounter. The corresponding value with sexually transmitted viral diseases was 1.72 compared with subjects with an earlier age at first sexual encounter. This is another finding that was not in agreement with the literature reviewed. For some racial groups, such as African American, Dariotis suggests that earlier age of first sexual encounter could be the explanation of higher rates of activities (Dariotis et al., 2011).

5.4 Recommendations for Future Research

Based on this study few recommendations can be made for future research. One there is a need to design a more robust study to explore the relationship between lack of health insurance and sexually transmitted disease. Another recommendation is to have a study that further investigates birth control and educational programs to make women more aware of their increase risk of sexually transmitted diseases. Lastly to reduce respondent bias, include doctor records and health department data in research to get a more accurate account of sexually transmitted diseases.

5.5 Conclusion

The results of this study indicating differences in factors that are associated with sexually transmitted bacteria diseases and sexually transmitted viral diseases provide evidence for developing public health intervention that is based on type of infection. Public health intervention programs that address sex education, effect of IV drug use, the importance of health insurance, the use of birth control, circumcision, and smoking

cessation may help to curb the prevalence of both sexually transmitted bacterial and viral infections in at-risk groups.

REFERENCES

Adams J, Moody J, Morris M. Sex, drugs, and race: How behaviors differentially contribute to the sexually transmitted infection risk network structure. *American Journal of Public Health* 2013; 133(2):322-329.

Arama V, Vladareanu R, Mihailescu R, et al. Seroprevalence and risk factors associated with herpes simplex virus infection among pregnant women. *J. Perinat. Med* (2012); 36:206-212.

Averett S, Corman H, Reichman NE. Effects of overweight on risky sexual behavior of adolescent girls. *Economic Inquiry* (2013); 51(1): 605-619

Berg CJ, Painter JE, Sales JM, et al. Smoking as a risk factor for STI diagnosis among African American females. *Am J Health Behav* (2012);36(4):505-512.

Borges-Costa J, Matos C, Pereira. Sexually transmitted infections in pregnancy adolescents: Prevalence and association with maternal and fetal morbidity. *JEADV* (2012); 26: 972-975.

Bowers R. Research update: Male circumcision reduces risk of genital herpes and HPV infection. *STD Quarterly* (2009); 1:1-3.

Centers for Disease Control and Prevention National Health and Nutrition Examination Survey. Retrieved from : http://www.cdc.gov/nchs/nhanes.htm.

Centers for Disease Control and Prevention Reported STDs in the United States 2012 National Data for chlamydia, gonorrhea, and syphilis. Available at: http://www.cdc.gov/nchhstp/newsroom/docs/STD-Trends-508.pdf

Centers for Disease Control and Prevention Genital herpes CDC fact sheet. Available at http://www.cdc.gov/std/Herpes/STDFact-Herpes-detailed.htm.

Centers for Disease Control and Prevention Genital HPV infection- Fact Sheet. Available at: http://www.cdc.gov/std/HPV/STDFact-HPV.htm

Cheng WS, Garfein RS, Semple SJ, et al. Increased drug use and STI risk with injection drug use among HIV-seronegative heterosexual methamphetamine users. *Journal of Psychoactive Drugs* (2010); 42(1): 11-18.

Cox GR. Poor women with sexually transmitted infections: Providers' perspectives on diagnosis. *Online Journal of Rural Nursing ad Health Care* (2011); 11(2):63-75.

Dariotis JK, Plack JH, Sonenstein FL, et al. What are the consequences of relying upon self-reports of sexually transmitted diseases? Lessons learned about recanting in a longitudinal study. *Journal of Adolescent Health* (2009); 45:187-192.

Dariotis JK, Sifakis F, Pleck JH, et al. Racial and ethnic disparities in sexual risk behaviors and STDs during young men's transition to adulthood. *Perspectives on Sexual and Reproductive Health* (2011); 43(1):51-59.

Delavande A. Pill, patch or shot? Subjective expectations and birth control choices. *International Economic Review* (2008); 49(3): 999-1042.

Delany-Morelwe S, Chikandiwa A, Gibbs J. Human papillomavirus infection and disease in men: Impact of HIV. *SAJHIVMED* (2013); 14(4): 183-188.

Deluca GD, Basiletti J, Gonzalez JV, et al. Human papillomavirus risk factors for infection and genotype distribution in aboriginal women from northern Argentina. *Medicina* (2012);72:461-466.

Dickson NP, Roode TV, Herbison P, Paul C. Circumcision and risk of sexually transmitted infections in a birth cohort. *The Journal of Pediatrics* (2008); 152: 383-387.

Gallo MF, Macaluso M, Warner L, et al. Bacterial vaginosis, gonorrhea, and chlamydial infection among women attending a sexually transmitted disease clinic: A longitudinal analysis of possible causal links. *AEP* 2012;22(3):213-220.

Hipwell A, Sepp S, Chung T, et al. Growth in alcohol use as a developmental predictor of adolescent girls sexual risk-taking. *Prev Sci* (2012);13:118-128.

Jozkowski K, Rosenberger JG, Schick V, et al. Relations between circumcision status, sexually transmitted infection history, and HIV serostatus among a national sample of men who have sex with men in the United States. *AIDS Patient Care and STDs* (2010); 24(8): 465-470.

Kaestle CE, Ealler MW. Bacterial STDs and perceived risk among sexual minority young adults. *Perspectives on Sexual and Reproductive Health* (2011);43(3):158-163.

Kao TA, Manczak M. Family influences on adolescents' birth control and condom use, likelihood of sexually transmitted infections. *The Journal of School Nursing* (2012); 29(1): 1-10.

Khan MR, Berger AT, Wells BE, et al. Longitudinal associates between adolescent alcohol use and adulthood sexual risk behavior and sexually transmitted infection in the United States: Assessment of differences by race. *American Journal of Public Health* (2012);105(5):867-876.

Khan MR, Berger A, Hemberg J, et al. Non-injectable and injectable drug use and STI/HIV risk in the United States: The degree to which sexual risk behaviors versus sex with an STI-Infected partner account for infection transmission among drug users. *AIDS Behav* (2012); 17: 1185-1194.

Langhaug LF, Sherr L, Cowan FM. How to improve the validity of sexual behaviour reporting: Systematic review of questionnaire delivery modes in developing countries. *Tropical Medicine and International Health* (2010); 15(3):362-381.

Larke N. Male circumcision, HIV and sexually transmitted infections: A review. *British Journal of Nursing* (2010); 19(10): 629-634.

Lee Y, Dancy B, Florez E, Holm K. Factors related to sexual practices and successful sexually transmitted infection/HIV intervention programs for Latino adolescents. *Public Health of Nursing* (2013); 30(5): 390-401.

Lupi O. Prevalence and risk factors for herpes simplex infection among patients at high risk for HIV infection in Brazil. *The International Society of Dermatology* (2011);50:709-713.

McMumm VA, Caan W. Chlamydia infection, alcohol and sexual behaviour in women. *British Journal of Midwifery* 2007; 15(4):221-224.

McQuillian GM, Kruszon-Moran D, Korriri BJ, Curtin LR, Lucas JW, Kington RS. Racial and ethnic differences in the seroprevalence of 6 infectious diseases in the United States: Data from NHANES III, 1998-994. *Research and Practice* (2004); 94(11): 1952-1958.

Miskulin M, Miskulin I, Milas J, et al. Prevalence and risk factors for herpes simplex virus type 2 infection in East Croatia. *Coll. Antropol* (2011);35(1):9-14.

Mohola SA, Everett B. STD and HIV risk factors among US young adults: Variations by gender, race, ethnicity and sexual orientation. *Perspectives on Sexual and Reproductive Health* (2012);44(2):125-133.

National Insitiute of Health. X-Plain Sexually Transmitted Diseases. (2010). Retrieved from: http://www.nlm.nih.gov/medlineplus/tutorials/sexuallytransmitteddiseases/hp079105.pdf

Niccolai LM, Kershaw TS, Lewis JB, et al. Data collection for sexually transmitted disease diagnoses: A comparison of self-report, medical record reviews, and state health department reports. *AEP* (2005);15(3):236-242.

Owusu-Edusei K, Chesson HW, Leichltier JS, et al. The association between racial disparity in income and reported sexually transmitted infections. *American Journal of Public Health* (2013): e1-e7.

Pandey A, Mishra RM, Reddy DCS, et al. Alcohol use and STI among men in India: Evidences from a national household survey. *Indian Journal of Community Medicine*; 37(2): 95-100.

Pando MA, Balan IC, Dolezal C, et al. Low frequency of male circumcision and unwillingness to be circumcised among MSM in Buenos Aires, Argentine: Association with sexually transmitted infections. *Journal of International AIDS Society* (2013); 16: 1-16.

Pflieger JC, Cook EC, Niccolai LM, Connell CM: Racial/ethnic difference in patters of sexual risk behavior and rates of sexually transmitted infections among female young adults. *American Journal of Public Health* 2013;1:e1-e7.

Remis RS, Liu J, Loufty M, et al. The epidemiology of sexually transmitted co-infections in HIV-positive and HIV-negative African-Caribbean women in Toronto. *BMC Infectious Disease* 2013;13:550-563.

Rosengard C, Anderson J, Stein MD. Correlates of condom use and reasons for condom non-use among drug users. *The American Journal of Drug and Alcohol Abuse* (2006);32:637-644.

Sappenfield E, Jamieson DJ, Kouortis AP. Pregnancy and susceptibility to infectious diseases. *Infectious Diseases in Obstetrics and Gynecology* (2013);2013:1-8.

Singhal P, Naswa S, Marfatia YS. Pregnancy and sexually transmitted viral infections. *Indian J Sex Transm Dis & AIDS* (2009);30(2):71-78.

Springer YP, Samuel MC, Bolan G. Socioeconomic gradients in sexually transmitted diseases: A geographic information system-based analysis of poverty, race/ethnicity, and gonorrhea rates in California, 2004-2006. *American Journal of Public Health* 2013; 100(6): 1060-1067.

Wolf R, Freedman D. Cigarette smoking, sexual transmitted diseases, and HIV/AIDS . *International Journal of Dermatology* (200);39:1-9.

Yahya-Malima KI, Evjen-Olsen B, Matee MI, et al. HIV-1, HSV-2 and syphilis among pregnant women in rural area of Tanzania: Prevalence and risk factors. *BMC Infectious Diseases* (2008);8(75):1-8.