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**Method of Recruitment Produces a group of persons who look different from the
groups with HIV in most studies: A Case-Control study**

By

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A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial

Fulfillment of the Requirement for the degree of Master of Public Health

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Abstract

Introduction: More than 1.1 million citizens are infected with HIV and 40,000 new cases are reported annually. Between the years 2004-2007, the Centers for Disease Control (CDC) reported a 15% increase of HIV/AIDS incidence rate in 34 states with established HIV reporting. Although the incidence of HIV infection caused by illicit drugs injection and heterosexual activities have decreased, the CDC reported 26% of new HIV cases among men who have sex with men (MSM).

Objectives: The aim of this study is to reveal if the method of recruitment will produce a group of persons who look different from the groups with HIV in most studies. Also to examine the risk factors such as individual's behavior and characteristics that lead to the increase of HIV incidence despite the existence of different treatments that was claimed to be effective and the increased awareness of HIV infection. The risk factors examined in the study were alcohol intake, drug use, education level, marital status, and the socioeconomic status among people affected with HIV.

Methods: The data was obtained from the National health and Nutrition Examination Survey (NHANES) for the years 1999-2012, and it was retrieved from The Centers of Disease Control and prevention (CDC) website. A descriptive analysis was run on the sought variables to be examined, then cases and controls were matched for age ± 5 years, gender, and race/ethnic groups. The study is a case control study using a sample of 238 participants (N=238) in the age range of 0-80 years and residing in all 50 states. Demographic characteristics were examined for cases and controls. A conditional logistic regression was conducted to examine the risk factors associated with HIV status. Lastly, a comparison of cases and controls and the original data were conducted.

Results: The results reveal that the method of recruitment of participants did have an impact on the result of the study compared to other studies. It was also found that individuals who drink more than five alcoholic drinks per day increase the odds of being infected with HIV than those who do not.

Conclusion: The method of recruitment used by NHANES produced a group of persons who look different from the groups with HIV in other studies. The results of the study strongly suggests the association between risky behavior taken by individuals, such as alcohol drinking and HIV status. These findings also suggest that public health professionals have to increase the awareness of alcohol consumption among the public to reduce HIV transmission.

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Chapter I

Introduction

I.1 Background

According to the National Center for Biotechnology information (NCBI), the main role of the immune system is to defend the body against intruders, such as bacteria, parasites, and viruses. There are two types of immunity systems; the innate immune system, which is nonspecific and doesn't necessitate former contact with an antigen, and the adaptive immune system, which is more specific, and in order to be activated, it needs a prior contact with an antigen (NCBI, 2011). The cells of the adaptive immune system, also known as acquired immunity, are T cells and B cells. B cells have a role in humoral immunity, which is mediated by antibody-generating B cells. T cells have a role in cell-mediated immune response. There are two types of T cells; CD8 cells, which have the ability to kill infected cells, tumor cells, and allografts. And CD4 cells also known as helper T cells, which are immune response mediators, and their task is to help other specified cells to kill infected cells. Human Immunodeficiency Virus (HIV) is a virus that attacks the immune system of the human body leading to the demolition of CD4, which its principal function is to fight against infections (NCBI,2011). HIV infected CD4 cells are used by the virus to manufacture new viruses then die, leading to a diminished number of CD4 cells. The decline in CD4 cells makes the victims of HIV infection more susceptible to opportunistic infections(CDC,2014), lymphomas, and Kaposi sarcomas. Also HIV causes AIDS, which is a deadly disease. The transmission of HIV occurs by sexual contact, blood, and perinatally. People who are at greater risk of contracting HIV are homosexual men and intravenous (IV) drug users.

I.2 Purpose of the Study

HIV infection rate has increased in some parts of the U.S., especially in men who have sex with men (MSM) regardless of the use of antiviral therapy. The purpose of our study is to examine the method of recruitment will produce a group of persons who look different from the groups with HIV in most studies. And to examine the association of drug use (intravenously or by other means) and alcohol intake and HIV infection despite the sexual behavior risk. And to able policy makers and physicians to make the necessary recommendations in order to lessen the rising rate of HIV, especially among men who have sex with men.

Chapter II

Literature Review

II. 1. HIV infection associated with Illicit Drugs use and alcohol intake.

More than 1.1 million citizens are infected with HIV and 40,000 new cases are reported annually (Nelson & Bagdy, 2011). From 2004-2007, the centers for disease control (CDC) reported 15% increase of HIV/AIDS incidence rate in 34 states with established HIV reporting (Heath, Lanoye, &Maisto, 2011). Although the incidence of HIV infection caused by illicit drugs injection and heterosexual means has decreased (Heath et al., 2011), the CDC reported 26% of new HIV cases among men who have sex with men (MSM). Twenty-nine per cent to 60% of HIV infected individuals develop alcohol or other drug independency some time in their lives (Meyrhoff, 2001). Of 623 subjects with HIV/AIDS were included in a study, 40% of them reported using hard drugs and 50 % reported alcohol intake (Cohen et al., 2011). Moreover, in a nationally representative sample done between 1998 and 2003, in which 1711 individuals participated, 45% reported drinking alcohol, 10% were classified as hazardous drinkers, and 1/3 of the sample size used illicit drugs (Chander, Lau, &Moore, 2006). Hazardous alcohol use was associated with decreased antiretroviral therapy (ART) utilization and viral suppression compared to no alcohol use, and injection drug use (IDU) exacerbated this negative effect on ART use, adherence, and viral suppression (Chander et al.2006).

II.1.1. Association Between Alcohol Consumption and the Risk of Being Infected by HIV

Alcohol intake is more prevalent in HIV1infected patients causing a significant impact on immunological and virological responses to highly active antiretroviral therapy

(HAART), where the CD4 counts can be dropped to below 500 (Miguez, Sharposner, Morales, Rodriguez, & Burbano, 2006). Alcohol consumption has been found to cause HIV infection to progress to AIDS over a period of 3 months (Nelson & Bagdy, 2011). In vitro, alcohol has been proven to deteriorate host immune responses to HIV antigen and to accelerate indices of HIV induced dementia (Nelson & Bagdy, 2011), leading to poor judgment (Meyeroff, 2001). Moreover, alcohol helps in the accumulation of aldehyde in the gastro-intestinal system leading to the destruction of the epithelial tight junctions and promotes the growth and development of gram-negative bacteria, and the accumulation of endotoxin (Nelson & Bagdy, 2011). In addition, alcohol has the ability to enhance the intestinal permeability leading to excessive absorption of both toxins and antigens into the systemic circulation, initiating a cascade of inflammatory reactions (Nelson & Bagdy, 2011). Hence, the gastro-intestinal mucosa constitutes an important role in the progression of HIV infection; thus, its permeability leads to a chronic activation of the immune system, which stimulates HIV replication and the progression of the disease (Nelson & Bagdy, 2011). Also the increased absorption of alcohol in the gut through the production of acetyl aldehyde leads to an increase in target cells for HIV CD4 cells, which are used for viral replication and disease progression (Nelson & Bagdy, 2011). In an experiment, peripheral blood mononuclear cells (PBMC) were isolated from HIV sero-negative people, who were exposed to alcohol consumption. After PBMC were infected in vitro with HIV, the virus replication was increased. (Nelson & Bagdy, 2011). Also it has been shown that there was an increase in the number of CD4 cells in patients infected with HIV after alcohol withdrawal, proving the suppressing role of alcohol on the immune system. Also, a meta-analysis found that alcohol users presented a dose -

response relationship with HIV infection, for instance, heavy drinkers are more at risk of being HIV positive than moderate or non-drinkers (Fisher et al., 2007). Another study of community-recruited sample of African American has identified the relation between the frequency of alcohol consumption and HIV associated risk behaviors. The results of the study stated that a high frequency of alcohol use is associated with recurrent sexual transmitted diseases STDs infection, higher prevalence of HIV, lower rate of condom use, multiple partners during the past last 30 days, and lower knowledge about HIV prevention (Morrison, et al., 1998). Also, researches conducted a study on immune cells CD4 taken from the blood of healthy, Non-HIV infected cohort before and after they ingested from 3 to 9 alcohol drinks (Patterson & Wolf, 2010). It was found that the alcohol damaged the peripheral immune system. And when these cells were infected with HIV, the virus multiplied faster, concluding that alcohol and HIV have same similar effect on the immune system (Patterson & Wolf, 2010).

II. 1.2. The association between illicit Drug Use and the Risk of HIV Infection

Injection of drug use (IDU) is claimed to be the main root of HIV transmission worldwide. In the U.S., an estimation of 1.2million people are living with HIV, and drug use is common among this population. In some studies, it was found that 50% of HIV/AIDS patients used cocaine and 20% used marijuana (Rasbach, et al., 2013; Baum, et al., 2009; Cofransisco, et al., 2008;Hessol, et al., 2007). Outside of Africa, one third of the new HIV infections were among injection drug users, and in some countries this rate was much more higher (Werb, et al., 2012). For instance, in some countries IDU was the most important source of HIV infection (Werb, et al., 2012). In the Russian Federation, it was estimated that HIV prevalence was 1.9 million, where 35% was caused by IDU.

Similarly in Ukraine 60% of HIV infections were seen among people who used drug injections (Werb, et al., 2012). In a study conducted to examine if drug-related behaviors among HIV positive cohort were related to ART discontinuation, it was found that drug use was highly predictive of ART discontinuation (Werb, et al., 2012). Moreover, other studies have shown that non-adherence to anti-retroviral medication was highly associated with illicit drug use; hence, a greater occurrence of non-adherence behavior was associated with poly drug use, such as amphetamine, crack-cocaine, and opiates (Cohen et al., 2011). Although a research done on the usefulness of antiretroviral therapy on heterosexual couples and MSM, stated that the effective use of ART might reduce the transmission of HIV (Gonzalez et al., 2013) and that morbidity and mortality had declined since its introduction (Mutansky, 2008), however HIV infected drug users might have less access to ART (Confresco et al., 2008) and less adherence to ART (Hinkin et al., 2007; Mills et al., 2006) and less viral control (Confresco, et al., 2009; Qiam, et al., 2011), leading to the transmission of HIV. In addition to non-medication adherence, other studies showed that cocaine use lead to HIV disease progression by reducing the number of CD4 cells count, favoring HIV viral replication (Gonzalez et al., 2013). However, the type of drug used and its mechanisms by which ongoing use is related to adherence difficulties are understudied (Gonzalez et al., 2013).

II.2. Factors Associated with Alcohol and Drug Use of HIV Status

Different types of drugs are used in different geographic areas in the U.S., and their consumption is influenced by many factors. Therefore, studying the demographics factors such as age, gender, race/ethnicity, geographic area, socioeconomic status, marital status, and education in addition to other risk factors such as type of drugs used, patient-

physician relationship, and having a medical insurance is important to reveal the means of spreading of HIV among a population. Moreover, it allows policy makers and physicians to put some new recommendations to deal with the alarming rising rate of HIV infection.

II.2.1. Demographics

This study explored the demographic factors that were found to be associated with HIV infection in the literature. These factors are gender, age, education, Race/ethnicity, household income, marital status, and geographic areas.

II.2.1. 1. Gender and Age

According to The National Survey on Drug Use and Health (NSDUH), an estimated annual average of 42,000 persons aged 12 or older had been diagnosed with HIV/AIDS between 2005-2009. The rate of HIV/AIDS was higher among males than females (0.28 vs. 0.07 percent) and higher among persons aged 26 to 64 than among older and younger age groups. It was reported that 1 in 4 people living with HIV in the U.S. are women. African American and Hispanic/Latino women are more affected than White women (CDC, 2014). Of the newly diagnosed with HIV among women, 84% is from heterosexual contact (CDC, 2014). Also, Mustanky (2008) found that younger men constituted the majority of new cases of HIV infection among men who have sex with men, especially among ethnic minorities. Yet, older men who have sex with men engage more in sexual risk behavior (Mustanky, 2008). Also, findings stated that even though higher rates of HIV infection were seen in young MSM, older MSM suffered from more severe consequences, such as rapid decline in health and decrease in survival rate (Mutansky, 2008). Recent statistics show that MSM at the age of 40 and older constituted

a higher prevalence of HIV infection than men aged between 18 years and 39 years. However, these people were not aware of their infection and continued to spread the disease (CDC, 2013).

| Demographic Characteristic | Percent |
|------------------------------------|----------------|
| Gender, Male | 0.28% |
| Gender, Female | 0.07% |
| Age Group, 12 to 17 | 0.05% |
| Age Group, 18 to 25 | 0.06% |
| Age Group, 26 to 49 | 0.26% |
| Age Group, 50 to 64 | 0.22% |
| Age Group, 65 or Older | 0.06% |
| Race/Ethnicity, Non-Hispanic Black | 0.37% |
| Race/Ethnicity, Non-Hispanic White | 0.13% |
| Race/Ethnicity, Other* | 0.20% |

II.2.1.2 Influence of Education, Race/Ethnicity, and Income on Drug Use

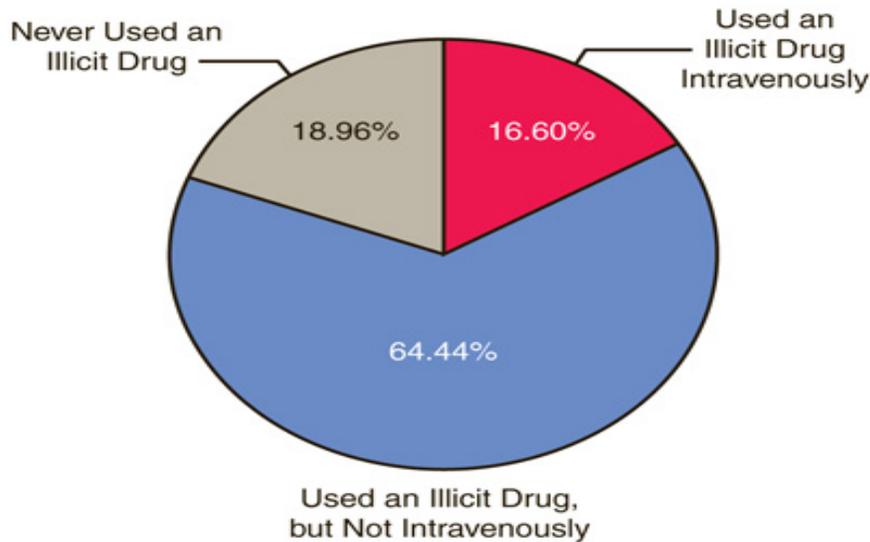
A demographic comparison was done among three groups; African American (AA) gay/bisexual, African American (AA) heterosexual, and white gay/heterosexual, found that both AA gay/bisexual and AA heterosexual had low income compared to white gay/bisexual. HIV prevalence among poor people is inversely associated with family income (Denning & Dinienno, 2013). Also the white had college education compared to AA gay/bisexual and AA heterosexual men (Siegel, Schrimshaw, & Karu,

2004). According to the National center for Education Statistics, 2008), AA and Latinos are more likely to attend high poverty schools than their Asian or whites counterparts. The number of high school dropout was the highest among Latinos and AA than among other ethnic groups (NCES, 2008). Additionally white gay/bisexual and AA gay/bisexual were less to be married or had one partner (Siegel et al., 2004). Moreover, NSDUH found that Non- Hispanic Blacks had higher rates of HIV/AIDS than Non-Hispanic Whites and persons in other racial/ethnic categories (0.37 vs. 0.13 and 0.20 percent, respectively). (Please, refer to table 1).

II.2.2 Type of Drugs Used

HIV infected more than 200,000 people through the use of injected drugs IDU. And this portion of people accounts for 15% of newly diagnosed HIV cases in 2006 (Hall et al., 2008). Studies have shown that IDU users were predominately AA, 11% were employees and 84% reported an annual income less that \$10,000 (Crystal et al., 2003) A study found that white gay/heterosexuals report the use of IV drugs less than the AA gay/heterosexuals and AA heterosexuals (Siegel et al., 2004). Conversely, the white gay/heterosexual men use marijuana more than the other groups. However, there is no difference in reporting hard drug use such as crack, cocaine and heroin (Siegel et al, 2004).

Additionally, NSDUH found that 18.96% among HIV/AIDS never used drugs, 16.0 used illicit drugs intravenously, and 64.44% used drugs by other means.



Source: 2005 to 2009 SAMHSA National Surveys on Drug Use and Health (NSDUHs).

II.2.3. Geographic Areas and Type of Drugs Used

There were no regional differences in drinking alcohol before sex among the different regions in the 50 states (Hiershfield, Remien, Humberstone, Walavalkar, & Chiasson, 2004). Furthermore, during the examination of the different types of drugs used in 6 regions; Northeast (NE), South Atlantic (SA), North Central (NC), Mountain (MTN), South Central (SC), and Pacific (PAC), it was found that crystal meth was mostly used in SA, MTN, and PAC (Hirshfield, et al 2004) and there was no difference by region for Gamma Hydroxybutyrate (GHB) and poppers use, however, Marijuana is more used in SA and PAC and Ketamine in SA and SC (Hirshfield et al., 2004). In general, NSDUH found that in metropolitan areas drugs are more used than in non-metropolitan and small metropolitan areas (table 2).

Table 2. Source: 2005 to 2009 SAMHSA National Surveys on Drug Use and Health (NSDUHs).

| Demographic Characteristic | Percent |
|--|----------------|
| Poverty Status, Living at or below Poverty | 0.41% |
| Poverty Status, Living above Poverty | 0.14% |
| County Type, Large Metropolitan | 0.25% |
| County Type, Small Metropolitan | 0.09% |
| County Type, Non-Metropolitan | 0.08% |

II. 2.4. Relationship between HIV/AIDS Patients and Physicians and Health

Insurance Coverage

HIV/AIDS is a deadly disease that needs to be treated seriously. It has been known that a good patient-physician relationship is the key to any treatment adherence for any disease and HIV/AIDS is no exception. A study was done on 1743 patients with HIV/AIDS, found that patients who knew the provider personally were 60% receiving HAART vs 43%, and 76% adhering to the medication versus 67%, they were followed in the clinic for a longer period of time, reported less stress, and were less likely to use illicit drugs or drink alcohol (22% vs 33% for drugs and 42% vs 53% for alcohol)(Beach, Keruly, & Moore, 2006). Also, other studies of HIV-infected women found that there is a role of race/ethnicity and substance use in receipt of HAART when insurance status is taken into account. Yet, analyzing data from the Women's Interagency HIV Study (WIHS), reported that women who were either African American or illicit drug users

have less access to HAART than their counterparts who were White or nondrug users, respectively (Blanton et al., 2010).

Chapter III

Methods

III. 1. Study Design and Data Source

Data examining the period between 1999-2012 was obtained from the National Health Examination Survey (NHANES), and taken from the Centers of Disease Control and Prevention (CDC) website. NHANES obtained data using a complex and multistage probability sampling design that allows the selection of a sample representative of American citizens who are not institutionalized. Health interviews were performed in participants' homes; health measurements were made in equipped mobile centers, which have the ability to travel to locations throughout the country. A team of physicians, medical and health technicians, as well as dietary and health interviewers conducted the study. Most of the staff are bilingual in English and Spanish.

To encourage participation, NHANES provided transportation to and from the mobile centers with compensation and medical records given to each participant. The NHANES interview included demographic, socioeconomic, dietary, and health-related questions. The examination component consisted of medical, dental, and laboratory tests administered by highly trained medical personnel. Five thousand individuals participated in the survey every year from 15 different sites from all 50 states including the District of Columbia. The purpose of the survey was to select a sample that represents the U.S. population of all ages. NHANES over-sampled individuals of age 60 and older who were African Americans and Hispanics to have statistic reliability. Comparable to prior cycles, participants who were 60 years old and older, African-American and low-income people were also oversampled. The NHANES study

procedure was approved by the institutional review board (IRB) of the National Center for Health Statistics. Oral and written consent were obtained from adults. For people who were under 16 years old, their assent was obtained after their parents gave oral and written approval.

III. 2. The Study Populations

The study consisted of 2 populations; the first population is the general population and is composed of 22,384 respondents collected from 1999 to 2012. Only 119 individuals were reported to be positive for HIV infection. To be eligible for participation, the respondents must be a U.S. citizen residing in one of the 50 states, aged from 0 to 80 years, and belong to at least one of the race/ethnic groups listed. The latter is constituted of individuals within the age range of 0-85 years at the screening making a sample size of 238 individuals, where 119 individuals were tested positive for HIV infection and 119 were controls (tested negative for HIV). The unique ID given to each participant, designed by NHANES as a sequence number (SEQN), was required to match the information on the demographic files to other data files such as laboratory and questionnaire data. The demographic characteristics include age, gender, race/ethnicity, household income, marital status, and level of education. Independent variables (risk factors) such as alcohol intake and drug use were examined. The dependent variable is HIV status.

III. 3. Statistical Analysis

a. Key Study variables

The questions addressed are:

1. If the method of recruitment will produce a group of persons who look different from the groups with HIV in most studies.

2. If economic status is associated with HIV infection.
3. If alcohol intake is associated with HIV infection.
4. If illicit drug use is associated with HIV infection.
5. If marital status is associated with HIV infection.
6. If education level is associated with HIV status.

The variables tested were taken from the demographic files from NHANES. These variables are age, gender, race/ethnic groups, marital status, education level, and family income.

b. Demographic variables

i. Race/ethnicity

NHANES classifies ethnicity as Non-Hispanic White (NHW), Non-Hispanic Black (NHB), Mexican American (MA), other Hispanic, and other races including multi-racial. For this study, race/ethnic groups were recoded to be NHW, NHB and other racial groups. For matching cases and controls, FUZZY was used. The match tolerance for race/ethnicity, had a rejection percentage of 99.9%

ii. Marital Status

Participants were classified by NHANES as either married, widowed, separated, never married, or living with a partner. For this study, people were re-classified either married or not married.

iii. Household Income

NHANES classification for household income was calculated according to the range value in dollars. Nineteen items were reported for the annual family income. For

this study, these items were recoded into two classes: below \$44,999 and more than or equal to \$45,000.

iv. Education Level

Possible responses of education level given by responders are less than 9th grade, 9-11th Grade (including 12th grade with no diploma), High School Grad/GED or equivalent, Some College or AA degree, and College Graduate or above. The answers were recoded into two categories: high school level or less, and some college or college graduate.

v. Drug Use

Possible answers to the question of drug use of cocaine, heroin, or methamphetamine were: yes; no; I don't know; or refused to answer. The answers were recoded as either yes or no. Missing data and data of people who refused to answer were categorized as "no".

vi. Alcohol Use

Respondents for the question of having more than 5 drinks per day are: yes; no; and I don't know. Missing data for this question were added to the data collected for "no" answer.

vii. Age

Respondents at the time of the survey were from year 0 to more than 80 years. Because of the small size of people who had been reported positive for HIV infection, all age groups were included in the study. For this case control study, case control tolerance match incremental rejection percentage was 86.2%

viii. Gender

Respondents were identified as either male or female. For the case control study, the incremental rejection percentage calculated by Fuzzy was 49.8%.

c. Dependent Variable

HIV Status

The test used to screen and aid in diagnosing HIV infection was the Genetic Systems HIV-1/HIV-2 plus O EIA. It is an enzyme immunoassay that utilizes recombinant proteins and synthetic peptides for the detection of antibodies to HIV-1 (Groups M and O) and/or HIV-2 in human serum, plasma, or cadavered serum specimens. All repeatedly positive specimens were confirmed by Western blot. Positive results were coded as “yes”, and negative results were coded as “no”.

III. Method of Study

The study is a case control study and the IBM Statistical Package for the Social Science (SPSS) version 22 was used to analyze the data and Fuzzy extension was used for the matching process. Because the sample size of HIV positive individuals was too small (119 individuals), matching cases and controls for age (± 5), gender, and ethnicity were conducted. For both populations, descriptive analysis was run on demographic variables: gender, ethnicity, marriage status, household income, and education level. Also, frequencies were calculated for other risk factors such as drug use and consumption of more than 5 alcohol drinks per day. The mean and standard deviation (SD) were calculated for the continuous variable “age”.

To examine the association between HIV status and the risk factors (matched cases and controls), conditional logistic regression was run and odds ratios (adjusted and unadjusted) were obtained. To compare each independent variable with the dependent variable, univariate analyses were run. Odds ratios were calculated and their significance were determined by 95% confidence interval and by calculating the p-values. Next, to examine if other factors (confounders) had impact on some variables, multivariate analysis was conducted by using conditional logistic regression. Odds ratios were calculated to identify the association between risk factors and the outcome and 95% confidence interval was determined as well as the p-value. Demographic variables (education, marital status, household income) were analyzed using both univariate and multivariate conditional logistic regression tests.

Chapter IV

Results

IV. Descriptive Summary

IV.1. The Original Data (NHANES) and Data after Matching.

For the original data, the answers of 22,384 respondents were collected from the year 1999 to 2012. Only 119 individuals were reported to be positive for HIV infection. The 22,384 participants met the eligibility criteria for the study, which were: being a U.S. citizen residing in one of the 50 states, aged from 0 to 80 years, belonging to one of the race/ethnic groups, Non Hispanic White, Non-Hispanic Black, and other race/ethnic groups were included. And for the second data, to match cases and controls, Fuzzy extension was used. Fuzzy could found 16 exact matches and the others were fuzzy matches and they were around 103 matches. By using the same eligible recruiting criteria, a sample size of 238 were chosen, where 119 were cases and 119 were controls. The results for the demographic profile for the general population and for the matched cases and controls are shown in table 1. The general population was composed of 11,117 (49.7%) males and 11,267 (50.3%) females. The matched cases and controls sample size was made of 115 (48.7%) males and 123 (51.3%) females. The mean age for both groups was close. Participants for the first group had a mean age of 32.18 with a standard deviation (SD) of 24.856, and for the second group, it was 34.7 with SD of 25.33. For race/ethnic groups, there were 8,302 (37.1%) Non-Hispanic White (NHW), 5,060 (22.6%) Non-Hispanic Black (NHB), and 9,002 (40.3%) for other races in the general population compared to 86 (36.1%) for NHW, 51 (21.4%) for NHB, and 101 (42.4%) for other races for the matched

cases and controls. For education, there were 6488 (29%) individuals with high school level or less for the first group versus 101 (42%) for the second group. And 6501 (29%) with some college or college graduates for the first group versus 72 (30.3%) for the second group. The prevalence for high school or less level for the second group was slightly higher than in the first group because of the missing data. Also for the first group, there were 6,563 (29.3%) married versus 72 (30.3%) for the second group. And 1,5821 (70.9%) unmarried, for the first group, compared to 166 (69.7) for the second group. For those who made less than \$44,999, there were 13,670 (61.1%) for the first group compared to 140 (58.8%) for the second group. And for those who made more than \$45,000, the first group was made of 8,714 (38.9%) and 98 (41.2%) for the second group. For drug users, there were 2,582 (11.5%) for the first group versus 29 (12.2%) for the second group. For non-drug users, there were 19802 (88.5%) for the first group versus 209 (87.8%) for the second group. As for alcohol consumption, there were 623 (2.8%) who drank more than 5 cups a day for the first group versus 13 (5.5%) for the second group. For those who drank less than 5 cups a day, there were 21761 (97.2%) for the general population compared to 285 (94.5%) for the second group.

Table 1. Demographic Profile for the Original Data And for Data After the Match

| | General population | Matched cases and controls |
|------------------------------------|-------------------------------|-----------------------------------|
| Sample size | N₁=22384(%) | N₂=238 (%) |
| Age in (years)^a | 32.2 ± 24.9 | 34.7± 25.33 |
| Gender | | |
| Male | 11117 (49.7) | 115 (48.7) |
| Female | 11267 (51.3) | 123 (51.3) |
| Race/Ethnicity | | |
| NHW | 8302 (37.1) | 86 (36.1) |
| NHB | 5060 (22.6) | 51 (21.4) |
| Other race | 9022 (40.3) | 101 (42.4) |
| Education | | |
| High School level or less | 6488 (29) | 101 (42.4) |
| Some college or college graduate | 6501 (29) | 72 (30.3) |
| Marital Status | | |
| Married | 6563 (29.3) | 72 (30.3) |
| Other Status | 15823 (70.7) | 166 (69.7) |
| Household Income | | |
| Less than \$ 44,999 | 13670 (61.1) | 140 (58.8) |
| More than \$45,000 | 8714 (38.9) | 98 (41.2) |
| Alcohol Intake | | |
| More than 5 drinks/day | 623 (2.8) | 13(5.5) |
| Less than 5 drinks/day | 21761(97.2) | 225 (94.5) |
| Drug use | | |
| Yes | 2582 (11.5) | 29 (12.2) |
| NO | 19802 (88.5) | 209 (87.8) |

^a Value of age is mean ± standard error. N₁ represents all population. N₂ represents matched cases and controls.

IV. 2. Comparison between Cases, Controls, and the Original Data

A comparison of demographic profiles was conducted among general populations, cases, and controls. It revealed that the prevalence for some variables were close to each other among the 3 groups. For household income that was less than \$44,999, the prevalence for the general population was higher (61.1%) than its counterparts for cases (47.9%), and (46.2%) for controls. For income that was higher than \$45,000, the prevalence for the general population was (38.9%) and for cases, it was (36.1%), but it was higher in controls (46.2%). For high school level of education or less, the prevalence was the highest in cases (34.5%) followed by the one in the general population (29%), and the lowest one was seen in controls (26.1%). For those with some college or college degree, prevalence was the highest in the controls (73.9%), then in cases (65.5%), and the lowest one was seen in the general population (29%). For married people, prevalence for general population was (29.3%) with controls being (29.3%), and cases being slightly higher (31.1%). The prevalence of unmarried people for the general population and controls were (70.7%) and (70.6%), respectively. It was slightly lower for cases (68.9%). In the general population, prevalence of NHW was (37.1%), and in cases it was (37.%) , and in controls (35.3%). NHB prevalence was the highest among the general population (22.6%), and it was close for cases and controls being (21.8%) and (21%), respectively. Other races' prevalence was the highest among controls (43.7%), followed by cases (41.2%), and then the general population (40.3%). For people who drank more than 5 cups of alcohol, the prevalence was the highest among controls (9.2%), followed by the one for the general population (2.8%), and cases being (1.7%). For those who drank less

than 5 cups a day, the prevalence was the highest among cases (98.3%), followed by the general population (97.2%) and then the controls (90.8%). For those who answered “yes” to drugs, the prevalence was the highest among controls (12.6%), followed by cases (11.8%), and lastly the general population (11.5%). For those who answered “No”, the prevalence was the lowest in the controls group (71.4%), and it was (88.5%) for the general population and (88.2 %) for cases.

Table 2: Comparison of Demographic Profile of Original Data, Cases, and Controls

| | N₁=22384(%) | N₃ =119 N₃(%) | N₄=119 (%) |
|------------------------------------|-------------------------------|--|------------------------------|
| Age in (years)^a | 32.2 ± 24.9 | 34.7±25.5 | 32.1±24.8 |
| Gender | | | |
| Male | 11117 (49.7) | 57 (47.9) | 59(49.6) |
| Female | 11267 (51.3) | 62 (52.1) | 60(50.1) |
| Race/Ethnicity | | | |
| NHW | 8302 (37.1) | 44(37) | 42(35.3) |
| NHB | 5060(22.6) | 26(21.8) | 25(21) |
| Other race | 9022 (40.3) | 49(41.2) | 52(43.7) |
| Education | | | |
| HS or less | 6488 (29) | 41(34.5) | 31(26.1) |
| SC or CG ^b | 6501 (29) | 78(65.5) | 88(73.9) |
| Marital Status | | | |
| Married | 6563 (29.3) | 37(31.1) | 35(29.4) |
| Other Status | 15823 (70.7) | 82(68.9) | 48(70.6) |
| Household Income | | | |
| < than \$44,999 | 13670 (61.1) | 57(47.9) | 55(46.2) |
| > than \$45,000 | 8714 (38.9) | 43(36.1) | 55(46.2) |
| Alcohol Intake | | | |
| > than 5 drinks/d | 623 (2.8) | 2(1.7) | 11(9.2) |
| < than 5 drinks/d | 21761(97.2) | 117(98.3) | 108(90.8) |
| Drug use | | | |
| Yes | 2582 (11.5) | 14(11.8) | 15(12.6) |
| No | 19802 (88.5) | 105(88.2) | 85(71.4) |

^b Some college or college graduate.

N₁: general population. N₃: cases N₄: Controls

IV. 3. Conditional logistic Regression

To examine if there is an association between HIV infection and each of the independent variables, a conditional logistic regression was run after matching for cases and controls. The match was done for age ± 5 years, gender, and race/ethnicity. First, the logistic regression model was run for each variable independently to calculate the unadjusted odds ratios (OR). Second, conditional logistic regression model was run for all the variables together to calculate the adjusted OR.

IV.3a. Univariate Analysis

After running a univariate test, it was found that having an income less than \$44,999, some college or college education, being married, and using drugs were not associated with HIV status. However, drinking more than 5 cups of alcohol was strongly associated with HIV infection.

IV.3.b. Multivariate analysis

Conditional logistic regression model was run for all the variables together to control for other factors that might have an impact on the independent variables, and adjusted ORs were calculated. It was found that there was a statistically significant association between alcohol intake and HIV infection. And those who have some college or more education were found to be associated with HIV status and it was statistically significant. On the other hand, being married, making \$44,999 or less, having some or college education, and using drugs were found not to be associated with HIV status.

See table 3.

Table 3: Adjusted and Unadjusted Odds Ratios After Matching for Age, Gender, and Race/Ethnicity Using Conditional Logistic Regression.

| N ₂ =238 | Unadjusted OR (95% CI) | Adjusted OR (95% CI) |
|----------------------------|---------------------------|-------------------------|
| Household Income | | |
| \$45,000 and more | Reference group | Reference group |
| Less than \$44,999 | 0.62 (0.357-1.093) | 0.58 (0.329-1.045) |
| Education | | |
| HS level or less | Reference group | Reference group |
| Some college or more | 0.43 (0.165- 1.115) | 0.32* (0.106-0.944) |
| Marital Status | | |
| Other than married | Reference group | Reference group |
| Married | 0.88 (0.441- 1.767) | 1.08 (0.497-2.339) |
| Alcohol Consumption | | |
| Less than 5 drinks/day | Reference group | Reference group |
| Around 5 drinks/day | 5.50* (1.219- 24.81) | 8.90 *(1.718-46.16) |
| Drugs | | |
| No | Reference group | Reference group |
| Yes | 1.1 (0.467-2.590) | 1.19 (0.467-3.056) |

* Statistically significant (p<0.05).

IV. 4. Method of Recruitment and People with HIV

According to some literature, HIV infection was associated with drug use (werb,2013). And 50% of those infected used drugs, such as cocaine, and 20% used marijuana (Rasbach, et al., 2013). Also, according to Meyrhoff (2001), 29% to 60% of HIV infected individuals develop alcohol or other drug dependency some time in their lives. Of 623 subjects with HIV/AIDS were included in a study, 40% of them reported using hard drugs and 50% reported alcohol intake (Cohen et al., 2011). Moreover, in a study, 45% of participants reported drinking alcohol, 10% were classified as hazardous drinkers, and 1/3 of the sample size used illicit drugs (Chander, Lau, & Moore, 2006). Moreover, NSDUH found that HIV infection prevalence is higher in NHB group followed by other races, then NHW group, (0.37 vs. 0.13 and 0.20 percent), respectively. Also, HIV infection is more prevalent in men than women (NSDUH). However, from NHANES data, prevalence of alcohol was 2.8% and for drugs, a 11.8%. Also, according to the data in NHANES, HIV was more prevalent in women than men (6% vs 5%). Adding to that, other races had the highest prevalence of HIV comparing them to other ethnic groups, followed by NHW then NHB (40.3%, 37.5%, and 22.6%), respectively. Based on the previous findings, the following hypotheses were accepted:

1. The hypothesis indicating that the method of recruitment will produce a group of persons who look different from the groups with HIV in other studies.
2. Alcohol consumption (more than 5 drinks per day) increases the odds of being HIV positive.

The rejected hypotheses were:

1. High school or less education level is associated with increased odd of being HIV positive.
2. A low household income is associated with increased odds of being HIV positive.
3. Being married is associated with HIV status.
4. Drug use is associated with increases odds of contracting HIV infection.

Chapter V

V.1.Discussion

According to the literature, alcohol was found to have a potential suppressing effect on immunity, enhancing the spread of HIV infection. Drug use, by injections or by other means, was stated to be associated with HIV infection, directly for the injected ones and indirectly for the ones used by other means. Drugs have the ability to weaken the immune system, rendering the human body vulnerable to diseases and HIV infection is one example.

This study was determined to examine if the method of recruitment will produce a group of HIV people who are different from their counterparts in other studies. Also it analyzed the association between risk factors such as household income, marriage status, education level, alcohol and drug intake, and HIV status among American citizens aged from 0 to more than 80 years. The hypotheses were: the method of recruitment of HIV people produces a group that is different from other studies. Also being married, having some college or college degree, and having low household income were associated with HIV status. The independent variables were consuming more than 5 alcohol drinks per day and using drugs; they were risk factors of being HIV positive. Results from conditional logistic regression (multivariate) found that having some college or college graduate education was associated with HIV status, and it was statistically significant after controlling for other factors (adjusted OR). Low household income was found not to be associated with HIV status. Alcohol consumption was found to be associated with increased odds of having HIV infection, and it was statistically significant for both tests.

For drugs, it was associated with increased odds of being infected with HIV, but statistically insignificant. Marriage was found to not to be associated with HIV status.

V.2.Strength and limitations

Even though the sample size of HIV positive individuals was small, which it constitutes a limitation for the strength of the study, matching cases and controls for age (± 5 , gender, and race/ethnicity) increased the magnitude of the sample size, making it relatively representative for the general population of the U.S. Also selecting controls for cases added strength to the study. In addition, matching eliminated the influence of confounders that were difficult to measure and helped to improve the efficiency of the study.

In case of limitations, there were a few; generalizability could not be established due to the sample size that was small. Also, because of the sample size, false-positive results or over estimation of the association might occur. The conclusion of the study does not correlate with the hypotheses for all the risk factors, except for two. In addition, missing data was enormous, especially for alcohol intake, which interfered with having reliable results.

V.3.Implications

The literature and the result of this study found that alcohol consumption was associated with HIV infection. Public health specialists, health policy makers, and physicians must focus on increasing awareness about the danger of alcohol consumption in the general population, and especially among HIV positive people or people at risk, in order to slow the progression of HIV to AIDS.

Also, to educate people of the danger of drug use especially for the one that is taken by other means than injections, knowing that the general public ignores the suppressive effect of drugs on the immune system.

V.4. Recommendations

Additional research needs to be done using a larger sample to examine the relationship between HIV and other risk factors such as drugs since the results were not conclusive and did not correlate with the literature. In particular, there is a dire need to increase awareness especially among people who drink more than 5 cups of alcohol per day because alcohol was strongly associated with HIV status. These preventive measures need the contribution of physicians at their local practices to spread the information to their patients, especially among binge drinkers. Also, public health specialists have to increase awareness among this range of population. Moreover, physicians and public health specialists need to teach the public of the danger of drugs especially ones not taken by injections, as the general public ignore its grim effect on the immune system.

V.5. Conclusion

In conclusion, the survey was conducted by NHANES, and demographic factors such as age, gender, race/ethnicity, education level, household income, and marital status were considered. Risk factors such as alcohol consumption and drug use were examined. It was found that the method of recruitment generated a group of people with HIV different from those usually selected for most studies. Alcohol intake was found to increase the odds of being HIV positive.

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