

Spring 5-2015

A Systematic Literature Review of the Relationship Between Alcohol Consumption and Highly Active Anti-Retroviral Therapy (HAART) in Patients Diagnosed with HIV/AIDS

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The University of Southern Mississippi

A Systematic Literature Review of the Relationship Between Alcohol Consumption and
Highly Active Anti-Retroviral Therapy (HAART) in Patients Diagnosed with HIV/AIDS

by

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A Thesis
Submitted to the Honors College of
The University of Southern Mississippi
in Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science
in the Department of Nursing

May 2015

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Abstract

According to the Global Information System on Alcohol and Health (GISAH), alcohol consumption causes more than 2.5 million deaths annually. This organization also attributes more than sixty different diseases in which alcoholism plays a significant role. Such diseases include the Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) (WHO, 2014). There are over 50,000 new cases of HIV reported each year. In the United States, it is estimated that more than 1.1 million people are infected with HIV, and about one in six people are completely unaware that they are infected (CDC.gov, 2013). A systematic literature review was done on twenty different studies to see the effects that the consumption of alcohol may have on adherence to highly active antiretroviral therapy (HAART) and the progression of HIV. This literature review examined these effects by looking at CD4+ cell levels, viral load, disease progression, and early mortality rates. In the results, it was shown that there may be a possible correlation between the consumption of alcohol and HAART non-adherence, as well as the consumption of alcohol causing disease progression and early death. This review also found that several different studies considered HAART non-adherence to be a multifactorial issue, which should be further researched to help with the treatment of HIV. In conclusion, an assessment of the consumption of alcohol should be done in all patients diagnosed with HIV/AIDS. Patient teaching is needed to teach about the possible effects that alcohol may have on HAART, and referral to support groups is needed to help with adherence to HAART therapy. Prevention strategies should be formed to help decrease the spread of HIV/AIDS in the United States.

Key Terms: HIV/AIDS, Alcohol consumption, highly active antiretroviral therapy, disease progression, adherence, and non-adherence

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Chapter One: Introduction

The consumption of alcohol during antiretroviral therapy may lead to medication non-adherence. Non-adherence could lead to both the progression and spread of HIV/AIDS. (Samet et al., 2004). When moderate amounts of alcohol are consumed, it can block the absorption of antiretroviral medications in the stomach. When the absorption is blocked, the patient receives an inadequate amount of the medication thereby reducing effectiveness of the antiretroviral medication. The consumption of alcohol can also block the metabolism of the antiretroviral medication in the liver. When the metabolism of the anti-retroviral is blocked in the liver, the medication stays in the system longer causing toxicity or increasing side effects. When a patient exhibit sides effects of medication they are more likely to skip doses, or discontinue the medication which can lead to non-adherence (Wilson, 1995). Since alcohol is an immunosuppressant, the consumption of alcohol among patients infected with HIV/AIDS taking HAART may increase their susceptibility to opportunistic infections (Baum et al., 2010). Lastly, when consuming large amounts of alcohol, the growth rate of HIV increases causing a viral overload and a decrease in CD4+ cells (Wilson, 1995).

Since the creation of HAART therapy in 1996, there have been developments in both the immune and viral outcomes in the treatment of HIV. In addition, both the life span and the quality of life have been increased in patients who are infected with HIV/AIDS. However, in order for the benefits of HAART to be achieved, patients must adhere to the medication regimen. The consumption of alcohol has been related with HAART non-adherence in multiple studies, yet the characteristics of the correlation are still vague and further research is still needed (Hendershot et al., 2009).

It was in the 1980's when the consumption of alcohol increased, and today a little over five liters per adult person is consumed every year worldwide. According to Baum et al. (2010), alcohol abuse was the third leading cause of death in 2007, with approximately five percent of the population drinking heavily and fifteen percent of the population binge drinking. The consumption of alcohol is common in populations infected with HIV/AIDS. Some studies show a prevalence of alcohol abuse of up to fifty percent in patients infected with HIV/AIDS (Baum et al., 2010).

During the release of HAART therapy, the research of the relationship between the consumption of alcohol and the disease progression of HIV was not adequately researched. The focus was placed on treating patients with this newly developed medication rather than looking at the possible effects of alcohol on patients infected with HIV/AIDS. The effects of alcohol and HAART therapy was not considered at this time (Samet et al., 2003). There are several studies on the consumption of alcohol and HIV disease progression that came about after the introduction of HAART. According to Baum et al. (2010), these studies established that alcohol results in an increase in the viral load, a decrease in CD4+ cells, and a decrease in adherence to HAART (Baum et al., 2010). This systematic literature review will look at research dealing with alcohol consumption and its relationship to the progression of HIV and adherence to HAART therapy.

Problem Statement:

Patients who are infected with HIV or AIDS must adhere to their medications regime in order to prevent the progression of HIV. They must also keep viral load levels low which decrease the effects of the virus on the body thereby decreasing complications

of the disease (AIDS.gov, 2012). Alcohol is a potential issue with antiretroviral medications because it is thought to affect patients negatively (Kalichman, 2009). According to Manuela et al. (2012), there is research that reports that alcohol consumption leads to the resistance of HAART, co-morbidity, and an increase in mortality rates. Given the spread of HIV/AIDS in the United States, the research shows that alcohol may negatively affect HAART compliance thereby causing non-adherence and subsequent progression of the disease.

Purpose of the Study:

The purpose of this study was to perform a systematic literature review of numerous research articles that examine the effects of alcohol on HIV/AIDS patients taking HAART. This review also explored research related to alcohol consumption as a catalyst leading to the progression of HIV/AIDS in patients who consume alcohol while prescribed anti-retroviral therapy. A descriptive correlational design was used.

This study could become the catalyst for future research to understand how to prevent the rise and spread of HIV/AIDS in patients who drink alcohol while taking HAART. Hopefully, the management of HIV and AIDS patients receiving HAART therapy will be improved.

Research Questions:

Research Question 1: Is there a correlation between alcohol consumption and HAART non-adherence?

Hypothesis 1

H₁: There is a positive correlation between alcohol consumption and HAART adherence

H₀: There is not a positive correlation between alcohol consumption and HAART adherence

Research Question 2: Does alcohol consumption play a role in the disease progression of HIV?

Hypothesis 1

H₁: Alcohol consumption does play a role in the disease progression of HIV?

H₀: Alcohol consumption does not play a role in the disease progression of HIV?

Definition of Terms:

Human Immunodeficiency Virus is a virus that can only be acquired by humans. This virus attacks and destroys the CD4⁺ cells in the body, which leads to a weakened immune system. Patients with HIV will have a CD4⁺ cell count less than 500 cells/mm³ (AIDS.gov, 2012).

Acquired Immunodeficiency Syndrome is an acquired syndrome because it is acquired after birth. Also, it is named a syndrome because it is a complex disease that has a range of different complications and symptoms. Patients with AIDS will have a CD4⁺ cell count less than 200 cells/mm³ (AIDS.gov, 2012).

A viral load is the quantity of HIV in the patient's blood. Antiretroviral medications are used to treat symptoms of HIV/AIDS by lowering the viral load in the body (AIDS.gov, 2012). The viral load and the CD4⁺ cells count are directly correlated when the viral load is high the CD4⁺ cell count is low and vice versa. (U.S. Department of Veteran Affairs, 2013).

CD4⁺ cells are the cells that send signals to activate the body's immune response when foreign bodies such as viruses or bacteria have entered the body. The CD4⁺ cells

are otherwise known as T-cells, and these are the cells that fight off infections and diseases in the body (AIDS.gov, 2012).

Opportunistic infections are infections that take advantage of weakened immune systems that cause severe illnesses (U.S. Department of Veteran Affairs, 2013). If patients have more than one opportunistic infection, they will be diagnosed with AIDS regardless of their CD4+ cell count (CDC.gov, 2013). Opportunistic infections are infections such as Tuberculosis, Candidiasis, and Histoplasmosis (AIDS.gov, 2012).

For the purpose of this study, adherence will refer to HIV/AIDS patients, who are prescribed antiretroviral medication and are taking the medication as prescribed. Non-adherence will refer to HIV/AIDS patients who are prescribed antiretroviral medication and purposely skip or forget to take prescribed medications as prescribed. Non-adherence can lead to the resistance of prescribed medications. If a patient becomes resistant to prescribed medication, the medication no longer works for a patient infected with HIV/AIDS. Resistance happens when the body creates a mutated strain of the virus that does not respond to the medication. When the patient becomes resistant to medications, the virus is no longer impeded from multiplying which results in a higher viral load and progression of the disease (U.S. Department of Veteran Affairs, 2013).

Many studies that examine alcohol consumption in patients infected with HIV/AIDS use the categories of: (a) non-drinkers or abstainers, (b) hazardous drinkers or binge drinkers, and (c) non-hazardous drinkers or non-binge drinkers. Non-drinkers or abstainers are those who do not consume any alcohol. Hazardous drinkers or binge drinkers are those who consume more than five drinks on the day that they consume

alcohol. Non-hazardous drinkers or non-binge drinkers are those that consume less than five drinks on the day they consume alcohol (Braithwaite et al., 2007).

Chapter Two: Literature Review

Alcohol Consumption and HAART:

After HAART became the treatment of choice for HIV/AIDS, studies began to examine the effects of certain factors that affect HAART such as the consumption of alcohol. According to Baum et al. (2010), such studies established that alcohol results in an increase in the viral load, a decrease in CD4+ cell levels, and a decrease in adherence to HAART (Baum et al., 2010). This systematic literature review examined the results of these studies.

According to Miguez et al. (2003), a cross-sectional analysis of HIV-infected drug users found that patients who consumed alcohol four or more times per week and who were receiving HAART, were four times less likely to achieve a reduced viral load and two times more likely to have CD4+ cell count below 500 cell/mm³ than moderate drinkers or abstainers (as cited in Baum et al., 2010).

According to Fabris et al. (2000), a small prospective study of patients infected with HIV taking HAART, found that there was no difference in those who attained a reduced viral load or decreased CD4+ cell count between heavy alcohol drinkers, moderate alcohol drinkers, and abstainers (as cited in Baum et al., 2010). However, a larger longitudinal study of patients infected with HIV with a history of alcohol problems found that the consumption of alcohol was significantly correlated with a decreased adherence to HAART and was negatively related with HIV viral load suppression (Samet et al., 2004). Also, according to Howard et al. (2002), a prospective study of 161 patients infected with HIV on ART found that poor adherence to HAART was considerably related to the consumption of alcohol (as cited in Baum et al., 2010).

According to Baum et al. (2010), the findings suggest that the consumption of alcohol may accelerate the progression of HIV through poor adherence to HAART. However, a seven-year prospective study on the relationship between heavy alcohol consumption and lower CD4+ cell counts in a cohort with HIV-positive patients not on HAART indicates that the consumption of alcohol may directly influence the progression of HIV through an effect on the CD4+ cell count (Samet et al., 2007). All patients with HIV or AIDS are treated with antiretroviral therapy. Anti-retroviral therapy is used to suppress the replication of the virus thereby improving the immune system. It is also used to increase the number of CD4+ cells which helps protect patients from opportunistic infections (Manuela et al., 2012). The goal of the treatment is to have positive outcomes, which will require close adherence to the medication regimen. If non-adherence occurs, then the virus can replicate and develop resistance, which can affect the patient negatively (Kalichman et al., 2009).

HIV/AIDS

There is no cure for HIV/AIDS. Taking medications for the treatment of HIV/AIDS is important because it can control symptoms and slow down the progression of the disease (AIDS.gov, 2012). However, the medications can only work if they are taken and taken correctly. The history of non-adherence to HIV/AIDS medications is a major problem. There are many reasons for medication non-adherence. However, but according to the research, alcohol consumption could be a major causative factor in medication non-adherence in patients with HIV/AIDS. According to Cook et al. (2001), it was found that nineteen percent of HIV-infected patients reported a drinking problem. Also, according to Cook et al. (2001), it was shown the compared with non-problem

drinkers, problem drinkers were more likely to take HAART off schedule (Cook et al., 2001).

In the United States, it is estimated that more than 1.1 million people are infected with HIV, and about one in six people are completely unaware that they are infected (CDC.gov, 2013). Human Immunodeficiency Virus has been traced back to a type of chimpanzee in West Africa (AIDS.gov, 2012). Scientists have identified these chimpanzees to be the source of infection found in humans (CDC.gov, 2014). Scientists believe that the simian immunodeficiency virus (SIV), the chimpanzee type of immunodeficiency virus was transmitted to humans where it transformed into HIV. It is believed that humans probably came in contact with the virus as far back as the 1800's by coming in contact with the infected blood from the chimpanzees when they hunted and ate them (AIDS.gov, 2012). Human immunodeficiency virus then spread slowly from Africa to other parts of the world. The virus has been in the United States since the mid to late 1970's (CDC.gov, 2014).

Human immunodeficiency virus can be found in many specific human body fluids, so patients become infected once HIV-infected fluids enter the body (CDC.gov, 2014). Fluids that contain high levels of HIV are blood, semen, pre-seminal fluid, breast milk, vaginal fluids, and rectal mucous. These fluids can be transmitted by sexual contact, pregnancy, childbirth, breastfeeding, intravenous drug use, occupational exposure, a blood transfusion, and even through an organ transplant (AIDS.gov, 2012). These fluids must come in contact with a mucous membrane, damaged tissue, or be directly injected into the blood stream by needle or syringe for the transmission of HIV to occur (CDC.gov, 2014).

Human immunodeficiency virus in the United States is mainly spread by having sex that is unprotected (CDC.gov, 2014). During sexual contact, whether it be oral, anal or vaginal, a person can come into contact with HIV infected body fluids. The body fluids can transmit the virus through the bloodstream through tiny cuts in the delicate linings of the vaginal canal, vulva, penis, rectum, and even the mouth (AIDS.gov, 2012). Anal sex has the highest risk of transmission while vaginal sex is the second-highest risk of transmission (CDC.gov, 2014). Patients can be diagnosed as HIV positive by taking two tests, a preliminary enzyme immunoassay (EIA) test and a confirmatory Western blot test. If these tests are positive, it means the patient is HIV-positive. This means that it is possible for them to pass the virus to others (AIDS.gov, 2012). Just because a patient receives a negative test result, does not mean they are not HIV positive. A negative test result can appear depending on when the patient may have been exposed to HIV (CDC.gov, 2014).

Once patients are diagnosed with HIV, it means that their CD4+ cell count is less than 500 cells/mm³. A normal CD4+ cell count is 800-2500 cells/mm³. When the CD4+ cell count reaches 350 cells/mm³ or below treatment needs to be started because the person is at risk for opportunistic infections. When a patient becomes infected with AIDS or the third stage of HIV, their CD4+ cell count will be below 200 cells/mm³. To slow the progression of HIV/AIDS and to treat the symptoms of HIV/AIDS, patients must take HAART (AIDS.gov, 2012).

Chapter Three: Methodology

Purpose and Research Design:

The purpose of this study was to perform a systematic literature review to examine the effects of the consumption of alcohol on patients infected with HIV/AIDS taking HAART. A systematic literature review was performed to find a more conclusive answer of how alcohol consumption affects patients infected with HIV/AIDS and prescribed HAART. The literature review encompassed research published in the United States during the years 2001-2012. It observed both men and women age eighteen and older, who were infected with HIV or AIDS, and who consume alcohol while taking HAART.

Data Collection

In the systematic literature review, a database search using Academic Search Premier, PubMed, Medline, Scopus, and Cinahl was done. Key terms used included; *HIV/AIDS, Alcohol consumption, highly active antiretroviral therapy, disease progression, adherence, and non-adherence.* The search was then narrowed by making sure it was peer-reviewed articles and by using the specific term "United States", so that no articles outside of the United States were pulled up. The research articles were then reviewed to see if they fulfilled the requirements or criteria.

Criteria

The criteria that were used for this research process was that all studies reviewed must consist of patients age eighteen years or older. Subjects could be female or male. The subjects included needed to have consumed alcohol while taking HAART. All studies must have been done within the United States. Also, each study needed to include

topics that look at the relationship between HIV/AIDS, alcohol consumption, and highly active anti-retroviral therapy.

By using the criteria as a guide, this researcher then searched extensively for studies that met all the criteria and requirements. This assisted with the decision of inclusion or exclusion of the different studies for the systematic literature review. The quality of each study was then determined by the strength of each article. A summary of each study was then done in order to explore the differences between each of the studies, to identify patterns among each of the study results, any contrast of results, or other relationships that may arise within the studies.

Chapter Four: Results

Effects of Alcohol on Adherence

In the following studies, it is seen that the consumption of alcohol may have an effect on adherence to HAART therapy in patients with HIV. The results of the Systematic Literature Review are summarized in Table 1.

In the first study chosen, the relationship between the consumption of alcohol and adherence to HAART therapy was researched through an observational study at eight different sites for HIV-positive veterans in a Veterans Aging Cohort Study. In this study, telephone surveys were performed to see if non-adherence to HAART therapy was associated with alcohol consumption. A total of 2,702 HIV-positive veterans were chosen. Of those the veterans chosen, 1,582 did not drink alcohol, 931 veterans were non-binge drinkers or non-hazardous drinkers, and 239 veterans were hazardous drinkers or binge drinkers. The veterans who abstained from alcohol missed medications only a little over two percent on the days surveyed. Non-hazardous drinkers or non-binge drinkers missed medications three and a half percent on days surveyed, and binge or hazardous drinkers missed medications eleven percent on surveyed days. Overall, the results of this study show that there may be an association between the consumption of alcohol and non-adherence in HAART therapy (Braithwaite et al., 2005).

In a cross-sectional analysis of 1,529 HIV-positive veterans, the association of alcohol and non-adherence to HAART therapy is researched by looking as far back as thirty days for drinking histories. This was done to find out adherence practices when drinking alcohol by performing telephone interviews. Within this study, it was realized through the telephone interviews that significant non-adherence was correlated with

consuming alcohol because patients who had at least two alcoholic drinks were non-adherence to their antiretroviral therapy. Anything over two alcoholic drinks showed significant non-adherence with patients taking HAART (Braithwaite et al., 2008).

In an observational clinical cohort of 1,711 HIV-positive patients, adherence practices to HAART when consuming alcohol was researched. In this study, patients partook in 5,028 interviews with ten percent of the patients being hazardous or binge drinkers and forty-five percent of the patients consuming alcohol in general. Hazardous or binge drinkers had a thirty-five percent decrease in adherence to HAART therapy compared to those patients who did not drink any alcohol. It can be seen in the results of this study that a high correlation exists between the consumption of alcohol and HAART non-adherence (Chander et al., 2006)

Another study searching for a correlation between alcohol and non-adherence to HAART therapy was done in a cross-sectional survey. In this cross-sectional survey, seventy-five HIV positive patients were given questionnaires at ten different sites. Over eleven percent of patients stated they missed at least one dose of HAART the day before, and over seventeen percent said they missed at least one dose of HAART two days before the interview. Patients in this study had multiple reasons for missing doses with sixty-six percent forgetting to take the dose altogether, and fifty-three percent being too busy to take HAART. Overall, all patients were more likely to consume alcohol or were taking drugs at the time of the study. In this particular study, multiple factors were suggested as being the reason for non-adherence to HAART therapy (Chesney et al., 2000).

In the next study, a Cross-sectional survey with 212 HIV-positive patients was done at two different outpatient clinics. At these two different sites, patients reported

their adherence to HAART through surveys. Results from the surveys showed nineteen percent had reported hazardous or binge drinking during the last month. Fourteen percent had reported missing a dose or more within the last day, and thirty percent of the patients did not adhere to the time medications were scheduled during the last week. Among all patients who drank, hazardous drinkers or binge drinkers were more likely to miss a dose and take HAART off schedule with seventeen percent being binge drinkers and fifteen percent being hazardous drinkers. According to Cook et al. (2001), non-adherence to HAART therapy was associated with hazardous drinking or binge drinking because hazardous drinkers or binge drinkers were most likely to report non-adherence to HAART (Cook et al., 2001).

In a prospective cohort study with a total of 140 HIV-positive patients on HAART, medication adherence was checked every four weeks at a county HIV clinic. This was achieved by doing pill counts and through patients self-report to the clinic. The patients who reported drinking alcohol were adherent to sixty-six percent of the doses compared to being adherent seventy-four percent of the time like non-drinkers. Also, it was shown that patients who used pill boxes or timers as an aid to take doses took seventy-eight percent of the doses compared to taking sixty-six percent of doses with no help from timers or pill boxes (Golin et al., 2002).

In another study, a meta-analysis was done with over 25,000 HIV positive patients in over forty different studies. A literature review was performed to find a correlation between the consumption of alcohol and non-adherence to HAART. In the results, those who consumed alcohol were only between fifty to sixty percent adherent to HAART therapy compared to patients who abstained from drinking and were ninety-five

percent adherent to HAART therapy. In this study, non-adherence to HAART was strongly correlated with the consumption of alcohol in patients with HIV (Hendershot et al., 2009).

In a cross-sectional study of 659 HIV-positive patients, patients were randomly selected from fourteen different sites. Patients were asked questions about alcohol use in the past month, and CD4+ cell levels and viral load levels were pulled from the clinical database. Over forty-two percent of the patients reported alcohol use in the last four months while on HAART. Patients who were hazardous drinkers or binge drinkers presently were more likely to be non-adherent than former binge drinkers or hazardous drinkers and patients who abstained from consuming alcohol altogether. Being a former drinker did not affect adherence at all, and current drinkers were more non-adherent to HAART (Hicks et al., 2007).

In a longitudinal random control trial, 224 HIV-positive patients were used to see if the consumption of alcohol was associated with non-adherence to HAART. In this study, adherence to HAART was checked at two weeks, three months, six months, and nine months at an outpatient HIV clinic through a medication adherence questionnaire. Also, alcohol consumption was checked through an alcohol use disorder identification test. The findings of this study showed that alcohol negatively impacted adherence to HAART therapy at each checkpoint except at three months. It was shown that social support helped with adherence. Overall, social support with taking medications could help with the negative impacts of alcohol use on adherence to HAART therapy (Lehavot et al., 2011).

In another study, a prospective cohort of 695 HIV-positive patients in an urban clinic was performed. Patients in this study completed surveys that addressed both adherence to HAART and consumption of alcohol. Patients who went from not drinking to consuming hazardous amounts of alcohol were seen to be less adherent than those patients who were hazardous drinkers and stopped drinking during HAART therapy. Also, patients who went from not drinking to consuming hazardous amounts of alcohol had an increase in CD4+ cell levels (Lucas et al., 2002).

In another study, cross-sectional data was pulled from a prospective observational cohort using fifty-two women with children to investigate their adherence to HAART therapy. Adherence was checked using a questionnaire given to the mothers to see what may be causing their non-adherence to HAART. Within their questionnaires, researchers found adherence rates to be from forty-three percent to fifty-six percent. It was found that many different factors lead to the poor adherence rates. These factors included alcohol consumption, stress from motherhood, and things such as having a partner or having inadequate beliefs about the benefits of HAART therapy. This study shows that alcohol could be a part of multiple factors that lead to non-adherence making it a multi-factorial problem that should be further researched (Murphy et al., 2002).

In a prospective cohort, 349 patients who were HIV positive were given surveys to fill out at six month intervals. Interviews were used to evaluate adherence to HAART in the 267 patients who were on HAART. When it came to correlating the consumption of alcohol and adherence to HAART, the patients on HAART seemed to be less adherent when consuming alcohol, but when abstaining from alcohol, adherence to HAART was

increased. The results of the study showed that any amount of alcohol consumed was associated with a decrease in adherence (Samet et al., 2004).

In a prospective cohort, 1,910 HIV-positive patients reported adherence rates to HAART therapy for four weeks prior to the survey. Non-adherence to HAART therapy was reported to be related to multiple factors such as psychiatric disorders, drug use, and alcohol use. In regards to alcohol consumption, patients who did drink alcohol were more likely to be non-adherent compared to the patients who did not drink. This study showed that non-adherence to HAART therapy can be multifactorial, but it still ties alcohol consumption in with non-adherence (Tucker et al., 2003).

Effects of Alcohol on Disease Progression

Of the literature chosen, it is shown that there were additional effects of alcohol on patients infected with HIV while taking HAART. There was a decrease in CD4+ cells that could lead to the progression of HIV. Baum et al. (2010) performed a prospective longitudinal study on a cohort of 231 HIV-infected patients. Frequent alcohol consumption was seen to be a factor in the decrease of CD4+ cells in patients who used antiretroviral therapy. In this particular study, the patients were followed for thirty months, and biannually blood was drawn to analyze the CD4+ cell count and viral load. The results of the study showed that frequent alcohol users who drank two or more drinks daily were about 2.91 times more likely to present with a decline of CD4+ cell levels to less than or equal to 200 cells. Also, frequent alcohol consumption was associated with a higher viral load, even in patients who were receiving HAART. These results show that the consumption of alcohol may have an effect on CD4+ cells and the viral loads leading to the progression of HIV in patients who are on ART (Baum et al., 2010).

A large observational cohort of 2,702 HIV positive patients was done to show an association with consuming alcohol and HIV disease progression. To show the effects of alcohol consumption on survival in patients with HIV, a computer simulation was used. The computer simulation was able to show the impact alcohol has on HAART, and on the survival in patients who are HIV positive. It showed that patients who consume hazardous amounts of alcohol were more non-adherent compared to patients who consumed non-hazardous amounts of alcohol. The results showed that patients who were non-hazardous drinkers or non-binge drinkers had a reduction in their life expectancy by more than a year if they drank at least once a week. Patients who drank daily had a decreased life expectancy by about three years. For hazardous drinkers or binge drinkers life expectancy was decreased by more than three years if alcohol was consumed at least once a week, and life expectancy was decreased by about six years if they consumed hazardous amounts of alcohol every day (Braithwaite et al., 2007).

In a prospective cohort of 881 HIV-positive veterans, the correlation between the progression of HIV and alcohol consumption was researched at three different HIV clinics. In this study, patients were given surveys related to their consumption of alcohol. The alcohol use disorder identification test was also used. The results determined that twenty percent were hazardous drinkers, and thirty-three percent were binge drinkers. It was also found that veterans with alcohol consumption problems were associated with complications such as disease progression, abnormal alanine transaminase or aspartate transaminase levels, anemia, and multiple hepatic diseases. In this study, alcohol seemed to be correlated with comorbidities and disease progression of HIV, which can lead to

early mortality in patients who consume alcohol while taking HAART (Conigliaro et al., 2003).

In a secondary analysis of a longitudinal cohort, 197 HIV positive patients were used to see if there was a correlation between the consumption of alcohol and the disease progression of HIV. In this study, patients were interviewed every six months for a total of seven times. Patients were asked about alcohol consumption for the past month and were also given breathalyzer tests before the interview started. Also, patients were to give a report on their adherence to HAART by reporting how many pills were taken daily compared to how many were prescribed. In the results, there was evidence that alcohol negatively affected adherence to HAART. It was shown that patients who consumed alcohol were not completely adherent to HAART, and had higher HIV RNA levels compared to those patients who did not drink. The rise in HIV RNA levels could result in the progression of HIV in patients who consume alcohol while taking HAART (Finucane et al., 2007).

In an observational clinical cohort, 1,030 HIV-positive women were used to associate the consumption of alcohol with adherence to HAART therapy. The time of death was correlated using the Kaplan-Meier statistics and Cox proportional hazards regression. In this study, it was found that twenty-nine percent of patients occasionally drank, seventeen percent were hazardous drinkers, and thirteen percent were past drinkers. Also, through the Cox proportional hazards regression model, HIV-positive patients who were hazardous drinkers were more likely to have an earlier death compared to patients who abstained from alcohol (Neblett et al., 2011).

In another study, a cross-sectional analysis was done on 349 HIV-positive patients whom all had histories of drinking alcohol. Patients were interviewed and given questionnaires, and CD4+ cell levels and viral load levels were reviewed in the medical record. In the results, patients who were moderate or hazardous drinkers had high HIV RNA levels and lower CD4+ levels compared to those patients who did not drink. Overall, with lower CD4+ levels and higher HIV RNA levels, patients who were drinking moderate to hazardous levels of alcohol are more likely to see a progression in HIV than those patients who did not drink (Samet et al., 2003).

In a prospective Cohort, 595 HIV-positive patients were checked up for a total of seven years to research the impact alcohol has on CD4+ cell levels and overall disease progression. Longitudinal regression models were used to try and find a correlation between the consumption of alcohol and the progression of HIV. Patients were interviewed and given questionnaires, and CD4+ cell levels and viral load levels were checked in the medical record. The results showed that thirty percent of patients were heavy alcohol drinkers, ten percent were moderate alcohol drinkers, and fifty-nine percent abstained from drinking alcohol. It was found that the consumption of alcohol affected those patients who were not on HAART because they had lower CD4+ cells. However, patients who were on HAART had CD4+ cells levels higher than those patients not on HAART. This study showed the possible correlation between the progression of HIV in patients who are not on HAART and found that CD4+ cell levels were lower in patients who drank alcohol when not on HAART (Samet et al., 2007).

The consumption of alcohol likely plays a critical role when it comes to adherence rates to HAART, the progression of HIV, the effects on CD4+ cells and viral

load, and for the increase in adverse effects such as drug toxicity (Bryant et al., 2006). In order to improve the treatment of HIV/AIDS, patients should be thoroughly assessed for alcohol use, support services should be used to increase adherence rates, and other factors should be researched to see if the cause of non-adherence is multi-factorial. Overall, prevention strategies should be the most important focus for stopping the spread of HIV.

Chapter Five: Discussion

Human immunodeficiency virus has been around since about the 1800's, its questioning interactions with alcohol and HAART have only been researched since around the late 90's. Since then, alcohol has been seen as a significant factor in non-adherence to HAART in patients with HIV. Also, it appears to be a factor in the effects on CD4+ cells and HIV RNA levels causing early mortality. Overall, it is still not a definitive cause of both non-adherence and early mortality in patients with HIV on HAART.

Although research shows a strong correlation between the consumption of alcohol with HAART non-adherence and early mortality, it is still inconclusive. There were a variety of measurements used in the studies and it cannot be said if alcohol is the primary or exact factor to cause such an effect on CD4+ cells and viral load in patients with HIV on HAART. One thing that was seen in all the studies is that there is no definitive assessment in patients on HAART when it comes to the consumption of alcohol and drug abuse. In order to help with adherence to HAART, healthcare providers should focus on the assessment of alcohol use in patients by asking for a thorough history of alcohol use and making sure to not misinterpret this information. A distinction needs to be made in the responses and what the patient may mean by "a few drinks". By performing thorough alcohol use assessments, healthcare providers can help adherence rates and can potentially prevent the progression of HIV in patients on HAART.

Another result shown in the studies was that non-adherence to HAART was caused by more than just alcohol use. Many factors contributed to non-adherence rates such as stress, forgetting to take HAART, having children, having partners, and even

feeling that taking HAART would not delay the progression of HIV. All of these factors should be further researched to find why there is such a strong correlation with non-adherence to HAART. Also, the exact causes for the effects of alcohol on CD4+ cells are still undetermined and should be further researched to pinpoint a more exact reason for a decrease in CD4+ cells when drinking alcohol on HAART.

Although research is only beginning to surface about the interactions between the consumption of alcohol and non-adherence to HAART, there are still many gaps in the research. Many factors need to be researched to find the exact mechanism in which non-adherence, disease progression, and early mortality occurs. Early and thorough assessment of alcohol use should be a priority in patients on HAART. Patients should be taught about the possible effects alcohol has on HAART, and referral to support groups should be used to help patients increase adherence rates. Also, patients should book follow-up appointments with healthcare providers to prevent complications. Lastly, preventative strategies should be formed to decrease the spread of HIV/AIDS in the United States.

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Appendix A

Summary of Articles Reviewed; Ordered by Alphabetical Order

Source	Purpose	Population	Study	Results
Baum et al., 2010	To see if the consumption of alcohol cause the progression of HIV through non-adherence.	231 HIV + patients	Prospective Longitudinal Study	Frequent alcohol drinkers are more likely to be non-adherent to HAART, which could lead to disease progression in patients with HIV.
Braithwaite et al., 2005	To determine if there is a relationship between the consumption of alcohol and non-adherence.	2,702 HIV + Veterans in Care	Observational Study, Veterans Aging Cohort Study	There is a relationship between alcohol consumption and non-adherence as binge drinkers were non-adherent 11% on days of drinking versus abstainers who were non-adherent only 2.4% of time during reported days.
Braithwaite et al., 2007	To see if alcohol affects survival of patients with HIV through non-adherence of HAART therapy	2,702 HIV + patients	Large Observational Cohort	Hazardous alcohol consumption had a major effect of survival by decreasing overall survival by three years and those who are non-hazardous drinkers, survival was decreased by about one year.

Source	Purpose	Population	Study	Results
Braithwaite et al., 2008	To see if the consumption of alcohol is correlated with non-adherence to HAART therapy in patients with HIV.	1,529 HIV + Patients	Cross Sectional Analysis	Non-adherence to HAART therapy was significantly associated with the consumption of alcohol.
Chander et al., 2006	To see the effects of the consumption of alcohol on adherence.	1,711 HIV+ Patients	Observational Clinical Cohort	Hazardous drinking was associated with non-adherence to HAART therapy compared to abstainers.
Chesney et al., 2000	To measure adherence to HAART therapy, and to find underlying reasons why non-adherence occurs in patients with HIV.	75 HIV + Patients	Cross-Sectional Survey	Patients who were non-adherent were most likely consuming alcohol, working away from home, or enrolling in clinical trials to gain access to medications.

Source	Purpose	Population	Study	Results
Conigliaro et al., 2003	To find and describe the correlation of alcohol consumption and the progression of HIV.	881 HIV+ Veterans	Prospective Cohort	Veterans who were binge or hazardous drinkers were associated with disease progression in HIV.
Cook et al., 2001	To find a correlation between the consumption of alcohol and non-adherence to HAART therapy.	212 HIV+ Patients	Cross Sectional Survey	Medication non-adherence was related to and seen more in patients who reported hazardous or binge drinking.
Finucane et al., 2007	To follow up on patients to see if there was an association of consuming alcohol and disease progression in patients with HIV.	197 HIV + Patients	Secondary analysis of a longitudinal cohort.	Patients who are infected with HIV and consume alcohol are not fully adherent to HAART therapy and have higher viral load levels which lead to the progression of HIV.
Golin et al., 2002	To see if there was an association between alcohol consumption and medication non-adherence.	117 HIV + Patients	Prospective Observational Cohort	Patients who drank alcohol were adherent to 66% of the doses compared to being adherent 74% with non-drinkers.

Source	Purpose	Population	Study	Results
Hendershot et al., 2009	To evaluate the findings across studies of the association of alcohol and non-adherence in patients with HIV.	Over 20,000 HIV + Participants	Meta-Analysis	There is a significant association between both the consumption of alcohol and non-adherence in patients with HIV, which could lead to overall disease progression in patients.
Hicks et al., 2007	To the effects of hazardous or binge drinking on adherence to HAART.	659 HIV+ Patients	Cross-Sectional	Hazardous or binge drinkers were less likely to be adherent than former drinkers or never drinkers.
Lehavot et al., 2001	To examine the impact of alcohol on HAART non-adherence	224 HIV + Patients	Longitudinal Random Control Trial	Consuming alcohol is negatively associated with adherence to HAART in patients with HIV.
Lucas et al., 2002	To assess the association with drinking alcohol and non-adherence.	695 HIV+ Patients	Prospective Cohort	Those who drank alcohol were correlated with non-adherence to HAART therapy, where as those who quit drinking were correlated with adherence

Source	Purpose	Population	Study	Results
Murphy et al., 2002	To find what causes non-adherence to HAART therapy with women with children.	52 HIV + Women with Children	Cross sectional data used from a Prospective Observational Cohort	Adherence rates were found to be 43%-56% due to multiple factors such as consuming alcohol, stress, partners, and children.
Neblett et al., 2011	To see if the consumption of alcohol was related to earlier death in women on combination antiretroviral therapy.	1,030 HIV + women	Observational Cohort	Hazardous alcohol consumption was associated with earlier death in women diagnosed with HIV on antiretroviral therapy.
Samet et al., 2003	To see if there is a relationship between the consumption of alcohol and the progression of HIV.	349 HIV+ Patients	Cross-Sectional Analysis	Patients who drink alcohol have low CD4+ levels which may have a significant impact on the progression of HIV.
Samet et al., 2004	To find an association between the consumption of alcohol and adherence HAART therapy.	349 HIV+ Patients	Prospective Cohort	Any amount of alcohol use is related to non-adherence to HAART Therapy in patients with HIV.

Source	Purpose	Population	Study	Results
Samet et al., 2007	To assess the correlation between alcohol consumption and the progression of HIV.	595 HIV+ Patients	Two Prospective Cohorts	Consuming alcohol has a negative impact on patients not on HAART because it lowers CD4+ levels.
Tucker et al., 2003	To investigate the association of HAART non-adherence with the consumption of alcohol.	1,910 HIV + Patients on HAART	Prospective Cohort	Moderate to heavy drinkers were more likely to be non-adherent than those who did not drink alcohol.