THE EFFECTS OF MARKERS FOR HIV DISEASE PROGRESSION, SOCIAL NETWORK, BARRIERS TO CARE, DEPRESSION, AND SUBSTANCE ABUSE ON MEDICAL APPOINTMENT ADHERENCE OF HIV-INFECTED ADULTS

by

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THE EFFECTS OF MARKERS FOR HIV DISEASE PROGRESSION, SOCIAL NETWORK, BARRIERS TO CARE, DEPRESSION, AND SUBSTANCE ABUSE ON MEDICAL APPOINTMENT ADHERENCE OF HIV-INFECTED ADULTS

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ABSTRACT

The study was designed to test a causal model of theoretical relationships among markers for HIV disease progression, social network, barriers to care, depression, substance abuse, and medical appointment adherence among HIV-infected adults. The proposed causal model was derived and developed from Lazarus and Folkman’s theory of stress, appraisal, and coping. The knowledge gained from this study may yield critical information with respect to determining how a health care provider or researcher can develop specific behavioral interventions for the improvement of medical appointment adherence among HIV-infected adults living in the Southeastern United States.

The correlational study was a secondary analysis of data from the UAB Center for AIDS Research 1917 HIV Clinic Cohort Database. Three hundred and thirty eight clients entering care during the period from 1 July 2009 through 30 June 2011 who met specific criteria were included in the secondary analysis. The analysis included data collected during an initial baseline measurement at entry into care and the pattern of adherence to medical appointments was observed over a 12-month period.

Structural equation modeling was conducted to test the proposed model using LISREL 8.4 software. The following proposed relationships among the causal model variable were found to be consistent with the data: (1) distance to treatment facility and
depression were found to have direct positive effects on adherence to medical appointments; (2) substance abuse was found to have a direct negative effect on adherence; (3) social network had a direct positive effect on substance abuse; and (4) HIV disease progression had a direct negative effect on substance abuse.

The fully trimmed model provided a good fit to the observed data, with a $\chi^2 (21, N = 338) = 22.31, p = .38$; GFI = 0.99; RMSEA = 0.03, and CFI = 0.99. Thus the null hypothesis of no differences was supported for the trimmed model. However, the model only accounted for eight percent of the variance in adherence to medical appointments ($R^2 = 0.08$). Longitudinal study of the relationships among causal model variable is recommended for deeper understanding of the pattern of HIV medical appointments adherence over time.

Keywords: adherence, lost to follow-up care, medical appointment, coping, barriers to care, HIV
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It has been said, that “a life is yours to create.” Doctorate school isn’t the most important thing you can accomplish in life, but good friends, treasured times, and simple happiness are there to be shared and celebrated. I cherished every moment of this grand adventure.
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<td>ADPH</td>
<td>Alabama Department of Public Health</td>
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<tr>
<td>AGFI</td>
<td>adjusted goodness-of-fit index</td>
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<tr>
<td>AIDS</td>
<td>acquired immune deficiency syndrome</td>
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<tr>
<td>ASSIST</td>
<td>alcohol, smoking and substance involvement screening test</td>
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<td>AUDIT-C</td>
<td>alcohol use disorder identification test</td>
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<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<tr>
<td>CFI</td>
<td>comparative fit index</td>
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<tr>
<td>GFI</td>
<td>goodness-of fit index</td>
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<td>HAART</td>
<td>highly active antiretroviral therapy</td>
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<td>HIV</td>
<td>human immunodeficiency virus</td>
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<td>IRB</td>
<td>Institutional Review Board</td>
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<td>MSM</td>
<td>men who have sex with men</td>
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<td>NFI</td>
<td>normed fit index</td>
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<td>polymerase chain reaction</td>
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<td>PGFI</td>
<td>parsimony goodness-of-fit index</td>
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<td>PHQ-9</td>
<td>patient health questionnaire</td>
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<td>relative fit index</td>
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<td>RMEA</td>
<td>root mean square error of approximation</td>
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<td>UAB</td>
<td>University of Alabama at Birmingham</td>
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<td>US</td>
<td>United States</td>
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<tr>
<td>VL</td>
<td>viral load</td>
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<td>World Health Organization</td>
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CHAPTER 1
INTRODUCTION AND OVERVIEW OF THE PROBLEM

Currently, there are more than 33 million people living with the human immunodeficiency virus (HIV) infection or acquired immunodeficiency syndrome (AIDS), worldwide (Joint United Nations Programme on HIV/AIDS & World Health Organization, 2009). The Centers for Disease Control and Prevention (CDC) estimates that approximately 50,000 people are newly infected with HIV each year in the United States (US) alone (Centers for Disease Control and Prevention, 2009). Within the 50,000 estimated new HIV infections in 2009, the most-affected subpopulations include men having sex with men (MSM), heterosexual women, heterosexual men, and injecting drug users (Centers for Disease Control and Prevention, 2009). At the present time, there are more than one million people living with HIV and AIDS in the US (Joint United Nations Programme on HIV/AIDS, 2010). In a recently updated report, HIV and AIDS still remained top US health priorities (U.S. Department of Health and Human Services, 2011b).

Evidence of the effectiveness of treatment with highly active antiretroviral therapy (HAART) has given medical providers and clients a new perspective of living with HIV disease. The life expectancy of clients receiving HAART treatment has been prolonged dramatically (Dieffenbach & Fauci, 2011). However, adherence to prescribed antiretroviral therapy is essential to achieve the benefits of therapy. Not all individuals
with HIV/AIDS are receiving the benefit of HAART therapy due to their non-adherence to prescribed regimens. Numerous factors have been associated with adherence to antiretroviral medications. One factor particularly important to medication adherence is adherence to medical appointments. Current research has demonstrated that the effectiveness of HAART is directly related to client adherence to medical appointments (Horstmann, Brown, Islam, Buck, & Agins, 2010). Gill, Mainous III, and Nsereko (2000) reported that non-adherence to scheduled medical appointments can and will threaten any continued plan of HIV care. If medical appointments are missed, the medical provider will not be given the opportunity to reinforce and stress the importance of the need to adhere to the medication regimen, conduct preventive health care interventions and promote health behavior changes to reduce risk taking behaviors that may prevent the transmission of HIV (Gill et al., 2000). For those clients who are on a medication treatment plan, non-adherence to scheduled medical appointments leads to client drift from the prescribed medical regimen and failure to refill much needed medication prescriptions (Gill et al., 2000; World Health Organization, 2003). Additionally, non-adherence to HAART treatment can result in the rise and development of new drug-resistant HIV strains, and thereby increase the likelihood of opportunistic infections, such as tuberculosis, cytomegalovirus and Kaposi’s sarcoma (Bangsberg et al., 2000; Gebo et al., 2010; Mofenson et al., 2009), which can result in more frequent, unexpected emergency department visits, prolonged hospitalizations, and a dramatic increase in future healthcare costs (Gill et al., 2000; Hubbard & Daimyo, 2010).

There is a growing body of research evidence examining the antecedents and outcomes of non-adherence to medical appointments on the health outcomes of various HIV-infected populations including HIV-infected adolescents, minority girls, young
women, and older adult women (Dietz et al., 2010; Dodds et al., 2003; Kempf et al.,
2010; Moneyham et al., 2010; Outlaw et al., 2010). In studies of women, non-adherence
to HIV-related medical appointments has been associated with younger age, lower
socioeconomic status, depression, ethnic background, and higher CD4 counts (Cat,
McClure, Jones, & Brantley, 1999a; Israelski, Gore-Felton, Power, Wood, & Koopman,
2001; Moneyham et al., 2010; Rana, Gillani, Flanigan, Nash, & Beckwith, 2010)
indicating that certain subpopulations are more vulnerable to non-adherence to medical
appointments than others.

There is also strong evidence that certain subpopulations of males are at high risk
for non-adherence to medical appointments. Giordano et al. (2005) explored adherence to
HIV-related medical appointments through a comprehension review of the medical
records of 2,000 HIV-infected men receiving care through the US Department of Veteran
Affairs. They reported that 17% of the men attended fewer than two medical appointment
visits within the first year of HIV medication treatment. Factors associated with missed
medical appointments from this sample of men were similar to those found for women.
However there were several differences between the two groups. In the sample of men, a
history of substance abuse and the presence of Hepatitis C were both strong predictors of
missed medical appointments (Giordano et al., 2005). Similar findings were reported by
Mugavero, Lin, Allison, et al. (2009), however, they found no association between
minority status and missed medical appointments.

A review of the research evidence indicates that there remains much to be
understood about factors that may influence adherence to medical appointments within
the context of HIV/AIDS. Interventions effective in promoting medical appointment
adherence for HIV/AIDS and subsequently, positive health outcomes, requires an
understanding of those factors driving adherence behavior. More importantly, identification of factors influencing adherence to medical appointments amenable to intervention is essential to the development of interventions that are predictably effective in keeping HIV-infected individuals engaged in care and treatment.

**Purpose of the Study**

Available evidence supports that markers of HIV disease progression, available social network, distance to treatment facility, health insurance, depressive symptoms and substance abuse by clients influence client behavior and medical appointment adherence. Although there is a growing body of research evidence indicating that all of these factors influence adherence to medical appointments, little to none of this research has focused on understanding the complex relationships among such variables or their combined effect on retention in care and treatment. This study addresses the gaps in the research that has been conducted to date and the evidence to guide interventions by exploring the effects of markers for HIV disease progression, social network, distance to treatment facility, health insurance, depression symptoms and substance abuse as related to medical adherence among HIV-infected adults living in the Southeastern US. A causal model of the proposed relationships among these variables based on theory and empirical evidence was tested (refer Figure 1).
Figure 1. Model of relationships among markers of HIV disease progression, social network, distance to HIV treatment facility, health insurance, depression, substance abuse, and HIV medical appointment adherence.
Research Hypotheses

1) Markers of HIV disease progression have a direct effect on adherence to medical appointments.

2) Markers of HIV disease progression have a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointment behavior through their direct effect on depression and substance abuse.

3) Social network has a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointments through its direct effect on depression and substance abuse.

4) Social network has a direct effect on adherence to medical appointments.

5) Depression has a direct effect on both substance abuse and adherence to medical appointments.

6) Depression has an indirect effect on adherence to medical appointments through its effect on substance abuse.

7) Substance abuse has a direct effect on adherence to medical appointments.

8) Distance to treatment facility has a direct effect on adherence to medical appointments.

9) Health insurance has a direct effect on adherence to medical appointments.
Conceptual Framework

The conceptual framework chosen for this study is Lazarus and Folkman’s cognitive-phenomenological theory of stress, appraisal, and coping (Lazarus & Folkman, 1984). Lazarus and Folkman define stress as a particular relationship between the individual and the environment represented by an imbalance between life demands and resources that results in psychological distress and associated sequela. In this theory, stress is treated as a broad construct or umbrella for a number of antecedent, processes, and outcomes that together explain individual variance in adaptation to difficult life experiences. A causal model of the hypothesized relationships tested in the research reported here is found in Figure 1. In the following sections, the antecedents, processes and adaptational outcomes of psychological stress are discussed in greater detail.

Antecedents

According to Lazarus and Folkman (1984), antecedents are personal and environmental factors that together determine an individual’s predisposition to experience psychological stress. Personal and environmental factors may serve either as stress-resistance resources which play a protective role, or as vulnerability factors which predispose an individual to experience psychological distress. Antecedent factors interdependently influence the processes that determine adaptational outcomes of psychological stress and thus account for individual variance in such outcomes. In this study, several antecedent variables were examined: (1) Socioeconomic variables; (2) markers of HIV disease progression; (3) social network; (4) distance to treatment facility; and (5) health insurance. Consistent with their definition, the antecedent variables
selected for study were examined in regard to their roles as stress-resistance or vulnerability factors.

**Socioeconomic Factors**

Although not included in the theoretical model tested in the current research, the effects of age, race, and gender have been identified as important factors in understanding variance in stress and coping processes within the HIV-infected population. Lazarus and Folkman (1984) noted that the processes of cognitive appraisal and coping are influenced by antecedent factors. For example, as a person ages, their coping efforts may become more effective because of their vast experience with difficult life situations and learning that has occurred over time. Lazarus and Folkman also identified the importance of cultural influences on how individuals appraise and manage life events, particularly as culture determines what behaviors are socially acceptable. For example, in some cultures, direct, assertive responses to resolving stressful situations with other people may not be the norm, thus more passive efforts to cope may be used. Gender differences also play a major role in human behavior development through socialization and cultural norms for men and women. Folkman and Lazarus (1988) acknowledged that there are gender differences in how individuals cognitively appraise and cope with events, and such differences are likely influenced by how men and women are socialized. In research of HIV-infected populations, age, race and gender have associated with differences in appraisal, coping and adaptational outcomes of stress (Lasser, Himmelstein, & Woolhandler, 2006; Laws, Wilson, Bowser, & Kerr, 2000; Mimiaga et al., 2009; Sajatovic, Micula-Gondek, Tatsuoka, & Bialko, 2011). They have also been linked to differences in resources that may be protective against stress (e.g, income levels)
(Dieffenbach & Fauci, 2011; DiMatteo, 2004; Kaiser Family Foundation, 2012) and the size of one’s social network (Sajatovic et al., 2011; Vyavaharkar et al., 2011), as well as the outcomes of stress such as depression (DiMatteo, 2004; Kaiser Family Foundation, 2012; U.S. Department of Health and Human Services, 2011a), and substance abuse (Dieffenbach & Fauci, 2011; Torian & Wiewel, 2011).

**Markers of HIV Disease Progression**

The most common markers of HIV disease progression used in clinical practice are CD4 cell count per mL and HIV by Polymerase Chain Reaction (PCR) viral load. Individuals with HIV disease are knowledgeable of the significance of these markers and most closely monitor any changes. Consequently, knowledge of the value of such markers can lead to psychological stress (Lazarus & Folkman, 1984). Persons who experience substantive increases in HIV viral load or decreases in CD4 cell counts often experience psychological distress (Kalichman, Difonzo, Austin, Luke, & Rompa, 2002b).

**Social Network**

Social network is considered as one dimension of social support (Geng, Nash, et al., 2010; Gottlieb & Bergen, 2010; Korthuis et al., 2008; Krueger, Berger, & Felkey, 2005). According to theory, social network(s) includes the establishment of social bonds without any form of prejudice or discrimination (Gordon, 1964). Social support has a direct effect on cognitive appraisal and coping responses (Lazarus & Folkman, 1984). Lazarus and Folkman expanded the definition of the concept of social support as the number and types of social relationships and the perception of the value of such relationship. The number of social relationships is termed the social network, and the
perception of social relationship is termed social support (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). The number of social relationships (social network) influences interpersonal communication/interaction, either through physical or emotional affection of love and understanding, caring and concern, respect and acceptance, companionship and financial assistance (Bowling & Browne, 1991; Cohen & Lemay, 2007; de Federico de la Rúa, 2007; Gordon, 1964).

There are numerous factors that may impact an individual’s social network. Being diagnosed with HIV disease can directly impact one’s social network, particularly because of the stigma associated with the disease. For example, HIV has been found to greatly limit the individual’s social network as the individual becomes more isolated due to the fear they may have to disclose their HIV status to others in their network (Amico et al., 2007; Brion & Menke, 2008; Goffman, 1986; Kempf et al., 2010; Rowe & Dowsett, 2008). HIV-infected adults may end up living alone, not only because of the fear of disclosing their status to significant others, but also because of loss of significant others over time to HIV disease. Evidence suggests that those who live alone have less support as compared with others who live with family, friends, or a spouse/partner (Catz et al., 1999a; Larios, Davis, Gallo, Heinrich, & Talavera, 2009; Madden et al., 2011). Research conducted over the past 20 years provides consistent evidence of the importance of support from significant others in the health outcomes of HIV-infected individuals (Adimora & Auerbach, 2010; Ball, Tannenbaum, Armistead, & Maguen, 2002; Bofill, Waldrop-Valverde, Metsch, Pereyra, & Kolber, 2011; Dobkin, De, Paraherakis, & Gill, 2002). Although, little research has examined the role that living alone could have on adherence of HIV-infected individuals, such individuals may lack the support and encouragement needed to schedule and keep medical appointments (Shippy, 2007). For
this study, the self-reported living arrangement, as in “living alone” or “living with others” will be used as a proxy for the measurement of the social network of adults living with HIV. Finally, any changes in the markers of HIV disease progression and how one perceives available social networks could directly or indirectly determine the adaptational outcomes of living with HIV disease.

*Distance to HIV Treatment Facility and Health Insurance*

Distance to HIV treatment facility and health insurance are commonly reported as barriers to HIV care. Living and having to travel a long distance to a treatment facility has been identified as a significant barrier to accessing HIV care (Arcury, Preisser, Gesler, & Powers, 2005; Mosoko et al., 2011; Whetten et al., 2006). Without dependable transportation, it is difficult if not impossible to access HIV care when one lives a long great distance from a treatment facility.

Research on access to HIV care has shown that health insurance is vitally important to bridging the gap in medical adherence (Mugavero et al., 2007). An individual’s socioeconomic status also plays an important role in medical adherence, psychological well-being and health outcomes, particularly as financial resources are important for coping. Socioeconomic status has often been used as a baseline to examine the structural component of an individual’s living environment. Examples of socioeconomic indicators that can be measured include income level, the types of health insurance one can afford, transportation, education levels, and any other component that can be used to measure or improve any financial resources and the quality of life. Socioeconomic resources decrease one’s vulnerability to stress and support effective coping in stressful situations. Lazarus and Folkman (1984) indicated that any form of
these structural components have a direct effect on how one behaves and copes in daily life. For instance, many stressful situations arise from a deficit in financial resources necessary to support health and well-being. If one is unemployed and cannot afford to purchase insurance, then the onset of an illness can create a crisis. The same is true for the lack of proper transportation, which is determined by financial resources.

In this study, markers of HIV disease progression, social network, distance to treatment facility, and health insurance status are considered antecedent resistance resources as defined by the Lazarus and Folkman model that have a direct impact on the processes that determine the outcomes of stressful life situations.

Processes

Lazarus and Folkman (1984) suggested that there are two critical processes that mediate the outcomes of stressful life situations: a) cognitive appraisal, and b) coping. Cognitive appraisal is a process by which an individual monitors and evaluates their relationship with their environment to determine threats to their well-being. Stress occurs when it is perceived that the demands of a situation (a person-environment relationship) outweigh the resources one has to cope with such threats. There are three types of appraisals involved in this process: 1) primary appraisal of threat, 2) secondary appraisal of coping options, and 3) reappraisal of one’s situation. This study will focus on primary and secondary appraisal.

Primary appraisal is the initial evaluation of a situation when one might ask oneself “what is it?”. A situation may be appraised as irrelevant, benign-positive, challenge, or stressful. A situation is appraised as irrelevant when it does not involve anything of importance to the individual, and no immediate action is required. A benign-
positive event represents a situation which has the potential for positive outcomes and poses no immediate threat to an individual. As with irrelevant appraisals, there is no expectation of harm-loss, and no action is generally required. A situation is appraised as a challenge when it involves potential positive outcomes that may be achieved if the individual is able to take the necessary action to achieve the desired outcome. Unlike irrelevant and benign-positive appraisals, the individual may experience both positive and negative emotions in response to a challenge. Positive emotions occur when the appraisal is focused on the positive outcomes that are desired. However, negative emotions can occur when one’s appraisal is focused on the possible failure to achieve the desired outcome. If one focuses more on the potential failure, then the challenge is experienced as a threat to one’s well-being. The appraisal associated with psychological distress is a threat. During the threat appraisal, the individual perceives that something of great value to them personally is at stake. The threat increases when the individual perceives that there is a high potential that harm will occur and there is little to nothing they can do to prevent the harm from occurring. Threat appraisal generally creates high levels of negative emotion and impacts functioning in activities of daily living.

Secondary appraisal occurs in situations that are appraised as threatening and involves a process of examining the potential risks/benefits of coping options in preventing harm/loss as a consequence of the situation. Secondary appraisal occurs as a precursor of coping. The process of secondary appraisal occurs when one determines what one can do to manage the situation that is causing one’s distress. Strategies one can use to manage difficult life situations are identified as coping efforts. Coping is a constantly changing behavior process in which one constantly manages their internal or external stressors (Lazarus & Folkman, 1984). As explained by Lazarus and Folkman,
there are two major categories of coping strategies: emotion-focused and problem focused. Emotion-focused coping focuses on internal events, and emotional responses driven by a stressful event. Stressful situations are characterized by uncomfortable, negative emotions in which individuals are motivated to take action. When an individual is overwhelmed by a difficult life situation, they may lack the coping resources to manage the event, and they often become overwhelmed by negative emotions.

Emotion-focused coping involves the use of strategies focused on reducing one’s psychological distress. Such strategies include avoidance/denial, and distraction. In contrast, problem-focused coping strategies focus on more active strategies aimed at resolving the situation that is causing one’s distress. Such strategies include seeking information and problem-solving strategies. An example of emotion-focused coping involves the case of a single man newly diagnosed with HIV disease. He is so upset and he refuses to believe that he is HIV-infected. He does not attend his scheduled medical appointments, begins drinking heavily and watching television every waking moment. He decides not to tell anyone about his HIV diagnosis because he is afraid of how they might react. When friends ask him what’s wrong, he says he doesn’t want to discuss it. In contrast, a problem-focused strategy alters the stressful event by an action taken to resolve the taxing problem. Problem-focused coping includes learning new-skills and finding alternative solutions to reduce the stressor. When applied to the previous scenario, a newly diagnosed individual would be problem-focused if they became more educated on HIV disease and those things they needed to do to stay healthy. They would also seek support by attending support groups, and disclosing their diagnosis to their closest family members and friends who would provide support and help. This problem-focused approach is more likely to have positive outcomes in this situation.
In this study, depressive symptoms were used as an indicator of stress appraisals, and substance abuse was an indicator of coping strategy. It should be noted that not all people living with HIV have depression or suffer from substance abuse. However, recent research shows that there is a strong correlation linking depression and substance abuse within the HIV infected population (Kaiser Family Foundation, 2012; Kempf et al., 2010; Konkle-Parker & Barnett, 2012; Vyawaharkar et al., 2011; Wohl et al., 2011; Wolitski & Fenton, 2011; Woolf & Braveman, 2011). In an event where one encounters a stressful situation, threat appraisals combined with negative coping are highly associated with poor psychological outcomes (Folkman et al., 1986).

Outcomes

According to Lazarus and Folkman (1984), there are three types of adaptational outcomes of psychological distress: a) social functioning, b) morale, and c) somatic health. All of these adaptational outcomes are directly determined by cognitive appraisal and coping processes. Social functioning describes how an individual fulfills various roles in a working or a social society. Morale indicates a strong satisfaction with how an individual feels about themselves, including positive or negative beliefs concerning their current state of being. Somatic health reflects an overall physical health status that is reflected in one's quality of life and sense of well-being. It is important to point out that these adaptational outcomes are not independent, and have a complex interrelationship within the entity and with each other. For example, poor morale can directly affect how a single father with two dependent children (social functioning) attempts to cope with financial restraints, while the unmanaged HIV symptoms (somatic health) associated with
emotional distress, can have a direct effect on health outcome by completely altering the outcomes of the event.

Social functioning is the focus of the study, with the adaptational outcome of adherence to scheduled HIV medical appointments as a major role required of HIV-infected adults. As discussed earlier, an individual’s appraisal and coping affect adaptational outcomes (Lazarus & Folkman, 1984). By using adherence to HIV scheduled medical appointments as an adaptational outcome in this study, we can better understand the influence of appraisal (depression), and coping on the study outcome. From this study, we can also identify whether appraisal and/or coping were appropriate points for intervention to promote better adherence to medical appointments. Both appraisal and coping mechanisms were considered keys to understanding the relationship between the personal-environment transaction and adaptational outcome in this study.
Conceptual Definitions

The independent variables for this study included, markers of HIV disease progression (CD4 cell count and viral load), social network (living arrangement), barriers to care (distance to HIV treatment facility, health insurance status), depression (PHQ-9), and substance abuse (drug abuse and alcohol abuse). The dependent variable for this study is HIV medical appointment adherence, which is sometimes referred to as missed visit proportion. Baseline measurement demographic characteristics were included and served as a baseline (age, race, gender, education level, and income level).

Demographics data. Age, race, and gender were included in the data for this study. Age was measured as the number of years since birth. Race was categorized as minority and non-minority. Gender was categorized as male and female. Education was defined as the reported total years of education completed. Income was defined as total monthly reported household income.

Markers of HIV Disease Progression. Human blood consists of cellular immune markers and virological markers. T-cells are a type of lymphocyte and they are also classified as white blood cells. There are two types of T-cells important to HIV disease progression: T-4 cells, commonly known as CD4+ “helper” cells, which function as the first line of defense in attacking infections. T-8 cells are commonly known as CD8+ "killer" cells that kill cancer cells and cells infected with a virus. There are three different types of measurement of virological markers one can use to estimate the amount of virus present in the host: serum core antigen levels, plasma viral load, and cell-associated virus. In general, higher viral loads are associated with HIV disease progression. For the purpose of this research, CD4+ and plasma viral load were used as measures of HIV disease progression.
Social Network. Social network is a form of social support. Social support includes perception of available support, including the amount of available support from significant others (networks), and satisfaction with available support (Lazarus, 1991; Lazarus & Folkman, 1984; Sarason, Sarason, Shearin, & Pierce, 1987). Mitchell (1969) defines social network as “a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved” (p. 2). There are many social network indicators: marital status, interaction with family members, friends, neighbors, co-workers, and a deep sense of belonging to social and religious groups (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). Several non HIV-related studies has utilized the living arrangement status as a proxy for social support (Schmaltz et al., 2007; Udell Ja & et al., 2012). Presently, there are no known HIV research areas that have utilized such indicators. For this study, the self-reported living arrangements, as in “living alone” or “living with someone else” were used as a proxy in measuring the social networks among adults living with HIV. Although the living arrangements were common proxies in examining limited social support networks, it is important to point out that living arrangement status does not perform well over time (Phillipson, Allan, & Morgan).

Barriers to Care. There are two markers of barriers to care used in this study: distance to HIV treatment facility and health insurance status. All data were based on self-report by the participant during the initial clinical orientation day. The distances to treatment facility was measured based on the reported zip code between the residence and treatment facility. Distance was measured in “miles”. Health insurance status was defined based on two categories: no health insurance, and has health insurance.
**Depression.** Depression interferes with daily life routine and causes emotional pain to oneself and those who care about the individual. The feelings are usually long-lived and stay present beyond a few days (Cocco & Carey, 1998). Depression is a reflection of cognitive appraisals that focus on threat. When a person is depressed, there is a change in one’s appraisal of their surrounding environment. This is evidenced by their perceptions and thinking that are focused on negative and threatening views of the world. For this study, the Patient Health Questionnaire (PHQ-9) was used to screen, monitor and measure the severity of depression (Spitzer, Kroenke, Williams, & Group, 1999).

**Substance Abuse.** Substance abuse is an emotion-focused form of coping that is used as a means of reducing one’s psychological pain, and is also a form of negative self-medicating to temporality reduce one’s distress. The definition of substance abuse encompasses: (1) drug abuse, and (2) alcohol abuse.

**Drug Abuse.** The definition of drug abuse is the misuse of a prescribed medication or over the counter drugs in excess of the provided directions, and any form of non-medical use of drugs. The various classes of drugs may include, but are not limited to: cannabis such as marijuana, solvents, tranquilizers, barbiturates, cocaine, stimulants, hallucinogens or narcotics (Cocco & Carey, 1998). For this study, a simplified version of The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) developed for the World Health Organization (2002) was implemented to interpret the possibility of substance abuse.

**Alcohol Abuse.** Alcohol abuse is a pattern of drinking that may result in harm to one’s health, interpersonal relationships, and/or ability to work. Alcohol is inclusive of: beer, wine, liquor or any other alcoholic beverage (Saunders, Aasland, Babor, De La
Fuente, & Grant, 1993). For this study, the Alcohol Use Disorder Identification Test (AUDIT-C) by Saunders et al. (1993) was used for screening for the possibility of alcohol abuse.

Medical Appointment Adherence. For the purpose of this study, medical appointment adherence was used as a marker of social functioning among adults living with HIV. Research has emphasized the importance of adherence to medical appointments by evidence that the effectiveness of HAART is directly related to client adherence to medical appointments (Horstmann et al., 2010). Non-adherence to scheduled medical appointments leads to client drift from the prescribed medical regimen and failure to refill much needed medication prescriptions on a consistent basis (Gill et al., 2000; World Health Organization, 2003). Finally, adherence to scheduled medical appointments may be linked back to demographics data, markers of HIV disease progression, socioeconomic status, social network, depression, and the high prevalence of substance abuse within the HIV population.

Assumptions

For the purpose of this study, the following assumptions were made:

1. Humans are not passive recipients of difficult life situations, they have the capacity to act on their world and change their circumstances.

2. An individual’s appraisal and perception of their world, while subjective, represents the individual’s reality.

3. The meaning one attaches to life events determines one’s responses and the outcomes of such events.
4. Depression and substance abuse are part of the social environments in which HIV-infected adults live.

5. HIV-infected adults are able to accurately answer the standardized self-report measures used in this research (PHQ-9, ASSIST and AUDIT-C).

6. The collected self-reported data reflect actual experiences encountered by the participants.

Summary

Presently, there are limited studies utilizing causal models to understand the complex relationships among markers for HIV disease progression, social network, depression, substance abuse and medical appointment adherence among HIV-infected adults in the Southeastern US. The Lazarus and Folkman (1984) theory emphasizes how one appraises and copes with the environment during a stressful event. The theory also recognizes the importance of personal and environmental factors in accounting for individual differences in response to difficult life situations. As indicated by Lazarus and Folkman, the processes of appraisal and coping mediate the relationship between antecedents and outcome factors and account for individual differences in outcomes. This research underscored the importance of assessing the effects of multiple person and environmental factors that account for individual differences in the outcomes of difficult life situations. Additionally, the power of the processes of cognitive appraisal and coping in determining the outcomes of difficult life situations is recognized. Since the theory is effective in identifying a multitude of precursors of such outcomes, it is of great value in identifying possible points for interventions to improve the outcomes of individuals with HIV disease. The knowledge gained from this study may yield critical information with
respect to determining how a medical provider or researcher can develop specific 
behavioral interventions. This information can be tailored according to the variables that 
have the most direct effect based on the medical appointment history adherence level of 
each individual client. The client may benefit from having this focused intervention and 
will gain a sense of trust and confidence in their medical provider and be more likely to 
return for future scheduled medical appointments.

Chapter 2 provides an overall review of literature based on the concept of 
adherence to medical appointments, in relationship with markers for HIV disease 
progression, social networks, depression, and substance abuse. Chapter 3 describes the 
methodology used and Chapter 4 provides the results from the data analysis. Lastly, 
Chapter 5 will discuss and focus on the findings, conclusions, and recommendations for 
future intervention research.
CHAPTER 2
REVIEW OF LITERATURE

HIV is a chronic disease that requires consistent engagement and treatment, and uninterrupted lifelong appointments with medical providers (Burgoyne, 2005; Persson, Ostergren, Hanson, Lindgren, & Naucler, 2002; Simoni, Frick, Lockhart, & Liebovitz, 2002). Retention in HIV care plays a major role in the successful management of HIV disease (Bofill et al., 2011; Burgoyne, 2005; Hightow-Weidman, Smith, Valera, Matthews, & Lyons, 2011b). Currently, there is little data available pertaining to the actual cost incurred by the healthcare system when HIV clients miss their scheduled medical appointments. However, it is estimated that non-adherence to medical treatment for chronic disease not only causes approximately 125,000 deaths each year, it also costs the healthcare system more than $100 billion annually (Robin, Giordani, Lepper, & Croghan, 2002).

A number of studies have examined the rate of missed HIV care appointments and report a range of 12% to 60% (Catz et al., 1999a; Israelski et al., 2001; Kissinger et al., 1995; Mugavero, Lin, Willig, et al., 2009). Mugavero and colleagues (2009) examined non-adherence to HIV medical appointments in a large clinical population (n = 1,221) and reported that clients who did not adhere to their scheduled HIV medical appointments during the first year of outpatient treatment visits had more than twice the rate of long-term mortality, as compared to clients who adhered to all of their scheduled appointments. Although retention in HIV care has become a research priority, there
remains much to be understood about what factors contribute to individual differences in adherence to HIV medical appointments, including psychological, social and environmental factors. Included among such factors, are the sociodemographic characteristics of the individual, the type and quality of available social support, and psychological factors associated with HIV disease (Courtenay-Quirk, Wolitski, Parsons, & Gomez, 2006; Vanable et al., 2011; Wohl et al., 2011). The review of literature that follows begins by examining the definition of retention in HIV care. Next is a critical review of available evidence of the associations among the variables of interest in the present research (markers of HIV disease progression, social networking, distance to treatment facility, health insurance, depression, and substance abuse) and in particular, their association with HIV medical appointment adherence.

Retention in Care and Medical Appointment Adherence

In the domain of HIV literature, the terms retention in care and adherence to medical appointments have been used interchangeably. Adherence is defined as the extent to which a clients’ behavior concurs with medical or health advice (Becker, 1985; Haynes, 1979), and returning for scheduled clinic appointments is considered an important component of adherence (Becker, 1985). Messeri, Abramson, Aidala, Lee, and Lee (2002) expanded this definition more broadly as a continuation of medical care that begins with the initial visit of the client and continues throughout the life of their chronic condition. However, there is little consensus in how to measure retention in care, particularly as adherence occurs over time and the acceptable length of time between scheduled appointments may vary across clinical settings. A review of the literature indicates several different interpretations of what constitutes retention in HIV care. The
actual interval of time between scheduled medical appointments varies according to medical facilities such that retention in care must be operationalized within the clinical context in which it is measured. Likewise, there is significant variance across clinical settings as to what point continuously missed appointments becomes “lost” to follow-up. Table 1 provides a summary of studies that examined various forms of retention in or lost to care and how each are operationalized. What is evident is that conceptual and operational definitions of both adherence to medical appointments and retention in care vary significantly.

Some studies utilized the frequency of missing visits as a baseline to measure retention rates among clients’ visits. However, there is great variance in how many missed appointments constitutes non-adherence to medical care. For example, non-adherence to medical appointments was defined as missing just one (Krebs et al., 2008), missing two (Deribe, Hailekiros, Biadgilign, Amberbir, & Beyene, 2008), or even missing three consecutive appointments (Amuron et al., 2007). In other studies, retention was defined based on intervals of time that passed after a client missed his/her scheduled HIV medical appointment (Geng, Bangsberg, et al., 2010), with time periods ranging from three weeks (Tweya et al., 2010), four weeks (Bisson et al., 2008; McGuire et al., 2010), six weeks (Dalal et al., 2008), eight weeks (MacPhail, Maskew, Menezes, & Rubel, 2007), 12 weeks (Bassett et al., 2009; Giordano, Hartman, Gifford, Backus, & Morgan, 2009; Hightow-Weidman, Smith, et al., 2011b; Mugavero, Lin, Willig, et al., 2009; Rosen & Ketlhapile, 2010; Yu et al., 2007), six months (Geng, Bangsberg, et al., 2010; Plitt et al., 2009; Rana et al., 2010; Torian & Viewel, 2011; Tripathi, Youmans, Gibson, & Duffus, 2010), and even as long as one year (Rice, Delpech, Chadborn, & Elford, 2011).
Currently, there is no consensus as to what constitutes retention in HIV care. However, the majority of the HIV care clinics in the US have adopted the concept of retention in HIV care as continuous engagement in scheduled care of at least one visit every three months during the first year of antiretroviral therapy (Bassett et al., 2009; Cheever, 2007; Giordano et al., 2009; Giordano et al., 2007; Hightow-Weidman, Smith, et al., 2011b; Mugavero, Lin, Willig, et al., 2009; Rosen & Ketlhapile, 2010; Yu et al., 2007). In clinical practice today, most clinically stable HIV-infected clients are recommended to have a regularly scheduled medical visit and return for follow-up care at least every 4 months. In addition, some clients might require more frequent scheduled appointments at the entry to care, and it is possible that the client might have to be placed on several different treatment regimens based on their state of health (New York State Department of Health AIDS Institute, 2012).

For the purpose of this study, the definition of adherence to HIV medical appointments was based on the total number of completed medical clinic visits divided by the total number of scheduled medical appointments during a 12-month period (Mugavero, Davila, Nevin, & Giordano, 2010).
Table 1

*Summary of Literature Review in the Lost to Follow-up Care among People Living with HIV/AIDS*

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>Sex</th>
<th>Race</th>
<th>Study period</th>
<th>HAART</th>
<th>Definitions</th>
<th>Total Number of Subject</th>
<th>Clients lost to follow-up</th>
<th>Comment/Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hightow-Weidman, Jones, et al., 2011)</td>
<td>(Bronx, NY; Chapel Hill, NC; Chicago, IL; Detroit, MI; Houston, TX; Los Angeles, CA; Oakland, CA; and Rochester, NY. )</td>
<td>x</td>
<td>x</td>
<td>2006-2009</td>
<td>x</td>
<td>Retention defined as having at least three HIV care visits within the first year after enrollment with at least one visit in the first 6 months and one visit in the second 6 months.</td>
<td>334</td>
<td>113 after 1 year</td>
<td>Only minority male population</td>
</tr>
</tbody>
</table>

*Note.* M = male; F = female; MSM = men who have sex with men; W = white; A = African American; O = other races; nr = no record; x = included part of the study; HAART = highly active antiretroviral therapy.
Table 1 (continued)

**Summary of Literature Review in the Lost to Follow-up Care among People Living with HIV/AIDS**

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>Sex</th>
<th>Race</th>
<th>HAART</th>
<th>Study Period</th>
<th>No</th>
<th>Yes</th>
<th>Definitions</th>
<th>Total Number of Subject</th>
<th>Clients lost to follow-up</th>
<th>Comment/Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Mosoko et al., 2011)</td>
<td>Southwest Region in Limbe, Cameroon.</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>2002-2005</td>
<td>x</td>
<td>nr</td>
<td></td>
<td>2920</td>
<td>Retention in less than 50% of client remained in care at two years and only 33% at three years.</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Schilkowsky, Portela, &amp; Sá, 2011)</td>
<td>Rio de Janeiro, RJ, Brazil</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1997-2007</td>
<td>x</td>
<td>nr</td>
<td></td>
<td>945</td>
<td>155</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Rice et al., 2011)</td>
<td>England, Wales, and Northern Ireland</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1998-2007</td>
<td>nr</td>
<td>nr</td>
<td>Lost to care defined as 12 months absent of visit</td>
<td>3697</td>
<td>472</td>
<td>No MSM</td>
</tr>
</tbody>
</table>

*Note. M = male; F = female; MSM = men who have sex with men; W = white; A = African American; O = other races; nr = no record; x = included part of the study; HAART = highly active antiretroviral therapy.*
Table 1 (continued)

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<th>Study</th>
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<th>Clients lost to follow-up</th>
<th>Comment/ Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Torian &amp; Wiewel, 2011)</td>
<td>Multiple sites New York, United States</td>
<td>x x x x x</td>
<td></td>
<td>No</td>
<td>Lost to care defined as last visit &gt; 6 months before close of analysis</td>
<td>650</td>
<td>609 (93.7%) made a second visit, 580 (89.2%) made a third, 554 (85.2%) a fourth, and 529 (81.4%) a fifth visit (45–48) months of the visit in which they initiated care.</td>
<td>Limited resource setting</td>
</tr>
<tr>
<td>(Geng, Bangsberg, et al., 2010)</td>
<td>Immune Suppression Syndrome Clinic, Uganda</td>
<td>x x</td>
<td></td>
<td>No</td>
<td>Lost to care 6 months absent of visit</td>
<td>3628</td>
<td>829</td>
<td>No MSM</td>
</tr>
</tbody>
</table>

*Note. M = male; F = female; MSM = men who have sex with men; W = white; A = African American; O = other races; nr = no record; x = included part of the study; HAART = highly active antiretroviral therapy.*
Table 1 (continued)

*Summary of Literature Review in the Lost to Follow-up Care among People Living with HIV/AIDS*

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<tr>
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</thead>
<tbody>
<tr>
<td>(Tripathi et al., 2010)</td>
<td>South Carolina, United States</td>
<td>x</td>
<td>x</td>
<td>2004-2007</td>
<td>x</td>
<td>optimal retention was defined as visits in four out of the four 6-month intervals; suboptimal retention was defined as visits in three out of four 6-month intervals; sporadic retention was defined as visits in two or one out of four 6-month intervals; and “dropout” defined as no visit recorded over 2 years.</td>
<td>2184</td>
<td>only 1092 (50%) had optimal retention</td>
<td>Limited resource setting</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td>(Howe, Cole, Napravnik, &amp; Eron, 2010)</td>
<td>North Carolina, United States</td>
<td>x</td>
<td>x</td>
<td>2001-2007</td>
<td>x</td>
<td>Study retention was based on Kaplan–Meier survival curve.</td>
<td>1791</td>
<td>130</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Rana et al., 2010)</td>
<td>Mississippi, United States</td>
<td>x</td>
<td>x</td>
<td>1999-2006</td>
<td>x</td>
<td>Optimal follow-up was minimum two visits with an HIV provider within 1 year of delivery</td>
<td>274</td>
<td>Only 109 (37%) of the women had optimal visit, 85 women (29%) had no visit</td>
<td>Female only</td>
</tr>
<tr>
<td>(Rosen &amp; Kethapile, 2010)</td>
<td>Themba Lethu Clinic, S. Africa</td>
<td></td>
<td></td>
<td>2008</td>
<td>x</td>
<td>Non-adherence defined as 3 months late for appointment</td>
<td>nr</td>
<td>869</td>
<td>MSM</td>
</tr>
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Note. M = male; F = female; MSM = men who have sex with men; W = white; A = African American; O = other races; nr = no record; x = included part of the study; HAART = highly active antiretroviral therapy.
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<tr>
<td>(Tweya et al., 2010)</td>
<td>Lighthouse Clinic, Lilongwe, Martin, and Preuss Center, Malawi</td>
<td>x</td>
<td>x</td>
<td>2006-2009</td>
<td>x</td>
<td>Non-adherence defined as 3 weeks late for visit</td>
<td>13,981</td>
<td>3098</td>
<td>No MSM</td>
</tr>
<tr>
<td>(McGuire et al., 2010)</td>
<td>MSF, Chiradzulu, Malawi</td>
<td>x</td>
<td>x</td>
<td>2004-2007</td>
<td>x</td>
<td>Non-adherence defined as 1 month late for appointment</td>
<td>11,683</td>
<td>1261</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Bassett et al., 2009)</td>
<td>South Africa</td>
<td>x</td>
<td>x</td>
<td>2006</td>
<td>x</td>
<td>Non-adherence defined as failure to complete 3 pre-ART visits or initiate ART</td>
<td>501</td>
<td>82</td>
<td>No MSM</td>
</tr>
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**Note.** M = male; F = female; MSM = men who have sex with men; W = white; A = African American; O = other races; nr = no record; x = included part of the study; HAART = highly active antiretroviral therapy.
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<tbody>
<tr>
<td>(Giordano et al., 2009)</td>
<td>VA hospital/clinic, United States.</td>
<td>x</td>
<td>x x x</td>
<td>x</td>
<td>Non-adherence defines as having had at least 1 quarter-year without any primary care visit in the year after starting antiretroviral therapy.</td>
<td>2619</td>
<td>36% of veterans had poor retention in care at 1 year</td>
<td></td>
</tr>
<tr>
<td>(Mugavero, Lin, Willig, et al., 2009)</td>
<td>1917 HIV/AIDS Clinic, United States</td>
<td>x</td>
<td>x x x x</td>
<td>x</td>
<td>Non-adherence was defined as Missed visits as determined for all study participants by evaluating appointment attendance records for 365 days after an initial attended primary HIV care visit.</td>
<td>543</td>
<td>325</td>
<td>Same setting for this study</td>
</tr>
</tbody>
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</thead>
<tbody>
<tr>
<td>(Plitt et al., 2009)</td>
<td>Northern Alberta, Canada</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>Non-adherence defined as last visit &gt;6 months after HIV diagnosis</td>
<td>458</td>
<td>7.2% sought care for the first time more than 6 months after HIV diagnosis. 7.8% never accessed care</td>
<td></td>
</tr>
<tr>
<td>(Bisson et al., 2008)</td>
<td>The Infectious Disease Care Clinics, Botswana</td>
<td>x</td>
<td>x</td>
<td>2003</td>
<td>x</td>
<td>Non-adherence defined as 30 days late for scheduled visit</td>
<td>410</td>
<td>68</td>
<td>No MSM</td>
</tr>
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<tbody>
<tr>
<td>(Dalal et al., 2008)</td>
<td>The Johannesburg Hospital adult HIV clinic, South Africa</td>
<td>x</td>
<td>x</td>
<td>2004-2005</td>
<td>x</td>
<td>Non-adherence defined as missing a scheduled appointment for 6 weeks</td>
<td>1634</td>
<td>267</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Krebs et al., 2008)</td>
<td>Lusaka ART Program, Zambia</td>
<td>x</td>
<td>x</td>
<td>2005</td>
<td>x</td>
<td>Non-adherence defined as missed visit</td>
<td>nr</td>
<td>1343</td>
<td>No MSM</td>
</tr>
</tbody>
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<tbody>
<tr>
<td>(Deribe et al., 2008)</td>
<td>Jimma University Specialized Hospital, Ethiopia</td>
<td>x</td>
<td>x</td>
<td>2003</td>
<td>x</td>
<td>Non-adherence defined as missing 2 or more monthly scheduled clinic appointments</td>
<td>1270</td>
<td>173</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Amuron et al., 2007)</td>
<td>The AIDS Support Organization, Uganda</td>
<td>x</td>
<td>x</td>
<td>2004-2006</td>
<td>x</td>
<td>Non-adherence defined as failure to complete 3 pre-HAART visits</td>
<td>2483</td>
<td>637</td>
<td>No MSM</td>
</tr>
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<th>Comment/Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MacPhail et al., 2007)</td>
<td>Themba Lethu Clinic, South Africa</td>
<td>x</td>
<td>x</td>
<td>2005</td>
<td>x</td>
<td>Non-adherence defined as missing a single clinic visit during a 2-month interval</td>
<td>nr</td>
<td>154</td>
<td>No MSM</td>
</tr>
<tr>
<td>(Yu et al., 2007)</td>
<td>Four public-sector ART facilities, Malawi</td>
<td></td>
<td></td>
<td>2004-2006</td>
<td>x</td>
<td>Non-adherence defined as 3 months of absence from clinic</td>
<td>5009</td>
<td>253</td>
<td>Female Only</td>
</tr>
</tbody>
</table>

*Note. M = male; F = female; MSM = men who have sex with men; W = white; A = African American; O = other races; nr = no record; x = included part of the study; HAART = highly active antiretroviral therapy.*
Markers of HIV Disease Progression

The two most common surrogate markers of HIV disease progression used in clinical practice are plasma HIV RNA viral load (VL) test and CD4 T-cell count (CD4 cell count). The VL is measured in copies per ml, and represents the actual number of virus in a person’s blood through quantitative PCR technique. In general, VL is used as an indication of the prognosis of an HIV-infected person, and it is also used to measure how the body reacts and responds to treatment with highly active anti-retroviral treatment (HAART). The number of VL is very sensitive and can be affected by any recent vaccinations, current active infections, and even the time of day the test is administered (Panel on Antiretroviral Guidelines for Adults and Adolescents, 2012). For this reason, The Panel on Antiretroviral Guidelines for Adults and Adolescents recommended that the medical provider examine the trend of the VL over time, and not draw conclusions from just one test result.

The CD4 cell count provides a good indicator of the status of the body’s immune system and it has been reported to be the strongest predictor of HIV disease progression and survival rates in HIV populations (Egger et al., 2002; Mellors & Munoz, 1997). There is an inverse relationship between VL count and CD4 cell count. In general, higher VL will lead to lower CD4 cell count because the HIV virus destroys the CD4 cells. In summary, research has indicated that VL strongly predicts the rate of decrease in CD4 cell count and progression to AIDS and death. Conversely, with effective HAART therapy, viral load often becomes undetectable. However, the progression of HIV disease is more accurately defined by a combined measurement of VL and CD4 cell count (Egger et al., 2002; Mellors & Munoz, 1997).
The Relationship of Viral Load and CD4 Cell Count to Medical Appointment Adherence

Several studies have explored the relationship of VL and CD4 cell count to medical appointment adherence. Jones, Cook, Rodriguez, and Waldrop-Valverde (2012) conducted a study to explore the relationship between personal knowledge of current VL and CD4 cell count status with medical appointment adherence. The research reported that among the sample of 210 participants, those who knew their current VL and CD4 cell count were twice as likely to adhere to their medical appointments as compared to participants who did not know their current VL and CD4 cell count status. Jones et al. (2012) further concluded that knowledge of one’s current VL and CD4 cell count increased the likelihood of engagement in care.

Higher CD4 cell count has also been reported to be linked with non-adherence to medical care appointments. Several studies have reported clients with higher CD4 cell counts missed significantly more medical appointments as compared with clients with a lower CD4 cell count (Catz, McClure, Jones, & Brantley, 1999b; Israelski et al., 2001). In more recent literature, Giordano et al. (2009) conducted a retrospective cohort study to explore the predictors of poor retention in HIV care settings. The research team reviewed a total of 2,619 HIV-infected men and their medical records from the US Department of Veteran Affairs. Among the findings, 36 percent of the clients had poor retention in HIV care. Among this group, a higher CD4 cell count was predictive of poor retention in care. In a separate study of medical appointment non-adherence among minority ethnic groups, Mugavero, Lin, Willig, et al. (2009) also reported that a higher CD4 cell count was highly correlated with missed medical appointments.
The Relationship of Viral Load and CD4 Cell Count to Depression

Ickovics et al. (2001) conducted a prospective, longitudinal cohort study from April 1993 through January 1995, with a follow-up through March 2001 to determine the association of depressive symptoms with HIV-related mortality and decline in CD4 cell count in a sample of 765 HIV-infected women aged 16 to 55 years. Participants were recruited from four different academic medical centers. Chronic depressive symptoms were associated with low or declining CD4 cell counts, suggesting that chronic depression may contribute to HIV disease progression. However, an important question is whether chronic depression has a direct effect on HIV disease progression, or whether the effect is indirect through non-adherence to HIV medical appointments. Further research is needed to understand the pathways through which chronic depression impacts the outcomes of HIV disease, including the effect on various markers of HIV disease progression and subpopulations with HIV disease.

Kalichman, Difonzo, Austin, Luke, and Rompa (2002a) conducted a 9-month prospective study (n =166) to determine if changes in the viral load count among HIV-infected adults could affect the psychological emotional well-being of the client. They reported that persons who experienced increases in viral load reported a significant increase in depression symptoms. Conversely, a major reduction of depression symptoms was noted among participants who experienced decreases in viral load to undetectable levels. Further studies are needed with various subpopulations to confirm the validity of these findings.

Summary. Although available research is minimal, findings accrued to date provide support of a relationship between markers of HIV disease progression and depression. However, there has been only minimal research that utilized VL and CD4 cell
count into medical appointment adherence studies. Further research is needed before conclusions can be reached about the linkages between changes in VL and CD4 cell count and symptoms of depression.

**The Relationship of Viral Load and CD4 Cell Count to Substance Abuse**

To date, there has been very little research exploring the relationship of VL and CD4 to substance abuse. It is possible that HIV disease progression may be associated with substance abuse, particularly if such substances are used to cope with the distress associated with HIV disease. In a cross-sectional study, Hampton, Halkitis, and Mattis (2010) utilized the data collected from a sample of 259 gay and bisexual men to explore how individuals cope with their serostatus (HIV positive versus HIV negative). An analysis was conducted to determine the differences between HIV-positive and HIV-negative men in relation to active coping strategies. Findings indicated that 64% of the HIV-positive participants (n = 25) had a greater likelihood of participating in illicit substance use and abuse as compared with HIV-negative participants (n = 78). Although the study did not specifically explore the relationship of VL and CD4 cell count to substance abuse, it provided evidence supporting the possibility of HIV-Infected adults with high VL or low CD4 cell count using substance abuse as a means of coping with the emotional distress associated with living with HIV disease.

**Summary.** Evidence of the relationship of VL and CD4 cell count to substance abuse is generally lacking. The only study providing evidence suggesting that such a relationship might exist was a cross-sectional descriptive study with all its limitations. Additionally, there are no studies which have directly studied the relationship between markers of HIV disease progression such as VL and CD4, with reported substance abuse.
However, in consideration of substance abuse as a strategy used by some individuals to cope with HIV disease, perhaps those feeling overwhelmed by their HIV disease and/or lack of coping strategies to effectively manage the disease may be more likely to fall back on those coping strategies they have used in the past such as the use of drugs and alcohol. However, research is needed to determine if such a relationship exists. Current study is attempting to explore this relationship.

Social Network

Social support has long been recognized as a resource that affects health outcomes, and there is an extensive body of research that supports this notion. Social support is a complex construct which is defined in various ways. A review of the literature revealed numerous definitions of social support that identified several key dimensions which include the number of people in one’s social network, commonly referred to as the size of one’s social network, the amount of available support, the types of support available (e.g., informational support, emotional support, instrumental support), and one’s satisfaction with the support available to them (Lazarus, 1991; Lazarus & Folkman, 1984; Sarason et al., 1987). One’s perception of and satisfaction with the network support that is available are particularly important as they are closely linked with the cognitive appraisal and coping processes that determine the outcomes of stressful life situations (Lazarus & Folkman, 1984). In the present study, social network was examined as a marker of social support which represents only one of a number of dimensions of social support (Geng, Nash, et al., 2010; Gottlieb & Bergen, 2010; Korthuis et al., 2008; Krueger et al., 2005)
According to theory, social network(s) include the establishment of social bonds without any form of prejudice or discrimination (Gordon, 1964). While social network support is important in any situation humans may experience, it is of critical importance in situations where the demands of the situation (stressors) are likely to exceed the resources available to the individual that would support effective coping strategies (social network support is one such resource). Thus, social network is generally conceptualized as a resistance resource that serves as a protective factor against difficult life situations.

Many researchers have examined and reported how social support influences HIV-infected individuals and how they adhere to and utilize medical services. This effect has been documented in many other chronically ill populations as well (Broadhead et al., 2002; Brook et al., 2000; Carrieri et al., 2003). Gallant (2003) reported that more and more interventions are focusing on enhancing social support in order to promote consistent medical service utilization and improving positive health outcomes in long term chronically ill populations. For this study, the self-reported living arrangement, as in “living alone” or “living with someone else” was used as a proxy in measuring engagement in a social network among adults living with HIV. Little research has examined living arrangement as a marker of social network; however, the proximity of individuals living together may make them an important social network component that may be critical in their adjustment to a chronic illness. Because of the lack of evidence of the role that this marker may play in medical appointment adherence, the review of literature that follows included evidence related to both social networks and the broader term social support.
The Relationship of Social Network to Medical Appointment Adherence

There is little research available linking social network to medical appointment adherence. In a study to identify psychosocial characteristics that were associated with non-adherence to medical appointments, Bofill et al. (2011) reported that out of 178 clients, 74 percent missed at least one scheduled medical appointment over a 12-month period. Bofill et al. further reported that within the same population of research participants, individuals who did not have family support (e.g., social network) had significantly lower rates of adherence to their scheduled medical appointments, with 80 percent of those participants missing two or more medical appointments in the same period. Such findings support the possibility that HIV-infected adults who live alone may have less support as compared with others who reside with family, friends, or a partner, which may in turn impact utilization of formal healthcare services including medical appointment adherence. However, conclusions cannot be made about these relationships without more empirical evidence (Shippy, 2007).

Summary. Although there is a body of research that has provided consistent evidence of a positive nature of social network supports, there has been only minimal research into the relationship between one’s living arrangement and adherence to medical appointments. Existing studies do not examine the relationship of the different dimensions of social network to adherence to medical appointments. Further research is needed before conclusions can be reached about the importance of social network in adherence to medical appointments.
The Relationship of Social Network to Depression

While conducting a study among HIV positive African American men and women in a rural southern region of the US, Stewart and colleagues (2005) found that perceived availability of support from social networks was associated with a greater use of mental health services, and more importantly, a reduction in depression symptomology. In a similar vein, Ownby (2010) assessed the feasibility of a peer intervention for HIV medical care adherence and found that a greater quality of network support was associated with lower levels of depression for all participants regardless of sociodemographic characteristics. Likewise, Mizuno, Purcell, Dawson-Rose, and Parsons (2003) found that among HIV-positive intravenous drug users, depressive symptoms were lower when participants perceived that social support was available and they had a reliable source of HIV medical care.

Summary. Research provides consistent support that social support plays a role in reducing depression and promoting the psychological well-being in the HIV infected population (Chesney, Chambers, Taylor, & Johnson, 2003; Stewart et al., 2005; Tate, Van Den Berg, Hansen, Kochman, & Sikkema, 2006; Valente, 2003; Vyavaharkar et al., 2007). However, very little of this research has examined the role that depression may play in adherence to medical appointments, thus, further research is warranted.
The Relationship of Social Network to Substance Abuse

Presently, there are volumes of research indicating social support has an inverse relationship with substance abuse among the adolescent population (Fergusson, Boden, & Horwood, 2008; Korhonen et al., 2008; Newcomb, Maddahian, & Bentler, 1986). However, little research has examined the relationship of living arrangement (as a marker of social network) to substance abuse in the HIV infected adult population. Knowlton, Hua, and Latkin (2005) suggested that social support may be more important to facilitate retention in care for an injection drug-using population than other populations. However, the nature of this relationship has not been examined to any great degree.

Depression

Depression has been reported as one of the most common co-morbidities of HIV infection (Simoni et al., 2011). Currently, the estimated prevalence of major depressive disorder among the HIV population ranges from 20 percent to as high as 37 percent (Bing et al., 2001; Valente, 2003), which represents a three-fold greater prevalence of major depression for HIV-infected populations as compared to the general population (Kessler et al., 2008). Research shows that depression not only has negative impact on the immune system, it also jeopardizes HIV treatment adherence (Ownby, 2010). In order to promote better adherence to treatment outcome, there is a need to understand and treat the depressive symptoms among HIV-infected clients (Ownby, 2010).
The Relationship of Depression to Medical Appointment Adherence

The prevalence of depression among the HIV infected population has been a concern of clinicians since the earliest days of the AIDS epidemic. For example, Holzemer et al. (1999) recruited 420 HIV-infected male and female participants from seven cities in the US. The purpose of the study was to examine the relationship of health-related quality of life issues and adherence in persons living with HIV. The three self-reported dependent adherence variables included medication non-adherence, adherence to provider counsel and advice, and missed medical appointments. Based on the analysis, Holzemer et al. reported that higher levels of depressive symptoms were strong predictors for medication non-adherence, non-adherence to provider counsel and advice, and missed medical appointments. In more recent studies, depression was also reported to be associated with non-adherence to HIV medication, missed medical appointments, and health status deterioration with HIV disease progression (Cook et al., 2004; Nancy et al., 2004; Weiser et al., 2006; Yun, Maravi, Kobayashi, Barton, & Davidson, 2005).

The Relationship of Depression to Substance Abuse

Rahav, Nuttbrock, Rivera, and Link (1998) conducted a descriptive study to explore the role of being homeless, mentally ill (depression), and a substance abuser in predisposing individuals to the risk of HIV infection in a sample of 350 male participants, of whom 33 were infected with HIV. Rahav et al. (1998) reported that men who were homeless, mentally ill, and substance abusers were at higher risk for HIV infection. They concluded that depression leads to risky intravenous drug practices, and that homelessness contributes to risky sexual conduct and contact (Rahav et al., 1998).
However, the relationship between depression and substance abuse is quite complex, the nature of which cannot be explained by simple cause-effect. For example, it is difficult to understand whether depression precedes and is a causal factor for substance abuse or vice versa. Substance abuse could possibly precede and contribute to depression. An example can be found in recent research conducted by Mimiaga et al. (2008), where 95 percent of the participants acknowledged that they encountered chronic depression and anxiety following the discontinued use of crystal meth. Therefore, the nature of the relationship between depression and substance abuse is not clear. Thus further research is warranted to sort out the complex relationships among factors that may contribute to non-adherence to medical appointments.

Substance abuse also encompasses alcohol misuse. People who struggle with alcohol abuse are found to be concurrently struggling with depression (Longmire-Avital, Holder, Golub, & Parsons, 2012). From a HIV treatment population in the Veteran’s Aging Cohort Study in the US, Justice et al. (2006) reported that 35 percent of the enrolled clients were classified as alcohol dependent, and therefore possibly vulnerable to depression.

Longmire-Avital et al. (2012) conducted research to investigate the interaction between depression and gender on alcohol abuse among HIV-infected African Americans. Interestingly, they reported that depression was the main predictor for alcohol abuse among African American men, but conversely, depression was not a significant factor in predicting alcohol abuse among African American women (Longmire-Avital et al., 2012). Lastly, both substance abuse and depression are serious problems within the HIV infected population. If left untreated, depression may greatly contribute to non-adherence to HIV medical appointments and ultimately contribute to increased morbidity
and mortality among the HIV-infected population as well as dramatically increase the cost of HIV care (Valente, 2003).

Substance Abuse

The HIV Costs and Services Utilization Study (HCSUS) was the first investigation that gathered and collected data on substance abuse from a nationally representative sample of HIV positive persons in care for HIV (Beckett et al., 2007). According to the HCSUS, alcohol and other substance abuse is a major concern when it comes to adherence to HIV treatment. Beckett et al. (2007) reported that about 8 percent of HCSUS participants engaged in alcohol abuse, and nearly 40 percent reported using an illicit drug other than marijuana. Of this group, approximately 15 percent of the illicit drug users screened positive for drug dependency (Beckett et al., 2007). Due to the potential impact of substance abuse on medical adherence among the HIV-infected population, research addressing the role of substance abuse in medical appointment adherence should be developed and studied further.

The Relationship of Substance Abuse to Medical Appointment Adherence

In exploring compliance with HIV medical care, Kissinger et al. (1995) followed the attendance of scheduled outpatient visits and client use of the emergency room. A total of 1824 HIV positive male and female clients were enrolled in the study. Based on the findings, Kissinger et al. (1995) reported that 15 percent of the participants missed their scheduled medical appointments, and 18 percent of the participants had at least one emergency room visit that might have been unnecessary, if one had adhered to the
scheduled medical appointment schedule. Intravenous drug use was identified as the major factor associated with emergency room visits and missed medical appointments.

Giordano et al. (2009) conducted a retrospective cohort study to explore predictors of retention in HIV care among a national cohort of US veterans. Out of the 2,619 male veterans, 36 percent were classified as having poor retention in their HIV care. They also reported that illicit drug use was found to be a major predictor of non-adherence to medical appointments.

The CDC Anti-Retroviral Treatment and Access to Services (ARTAS) study also reported that drug abuse was a major barrier for clients entering HIV care in the first year after learning one’s HIV status. Based on a recently conducted survey, ARTAS reported that only 36 percent of those with a recent history of cocaine use or injection drug use entered HIV care versus 63 percent of participants who had no history of substance abuse (The Health Resources and Services Administration, 2006). Such findings are alarming and indicate the significant relationship between substance abuse and missed HIV medical appointments.
The Relationship of Distance to Treatment Facility to Medical Appointment Adherence

Access to experienced HIV medical providers is an important part of the treatment process management. Studies have indicated that one of the major barriers to HIV care was the geographic distance to a treatment facility (Deribe et al., 2008; Geng, Nash, et al., 2010; Mosoko et al., 2011; Plitt et al., 2009; Sutton, Anthony, Vila, McLellan-Lemal, & Weidle, 2010).

Sutton et al. (2010) conducted a mail survey of rural HIV medical providers from the southern states to gain a better understanding of the facilitators and barriers to HIV testing and treatment services. The research team reported that an average 50 miles of travelling distance was reported between the referred site (respondent) and the HIV treatment facility. The medical provider perceived that distance to HIV treatment facility presented a barrier in HIV care.

Summary. Presently, the only research of the relationship of distance to treatment facility to adherence to HIV medical appointments within the U.S. was based on the perceptions of the medical provider. There has been no known reported data on the effects of distance to HIV treatment facility among HIV-infected adults in the Southeastern US. Therefore, further study is warranted.

The Relationship of Health Insurance to Medical Appointment Adherence

Currently, most literature linked the lack of health insurance as a type of barrier to care. Limited financial resources and the lack of health insurance has created a tremendous challenge to medical appointment adherence among adults living with HIV (Deribe et al., 2008; MacPhail et al., 2007; Mugavero, Lin, Willig, et al., 2009). In recent research, Muthulingam, Chin, Hsu, Scheer, and Schwarcz (2013) explored the HIV
surveillance data of San Francisco adults diagnosed with HIV during 2009-2010. The research measured the demographic characteristics, the time frame an individual linked with HIV medical care upon their HIV diagnosis, and the attendance rate on second and third HIV medical care visits. The result showed that of the 862 participants, 750 (87%) sought HIV medical care within six months of diagnosis. Of those seeking care within six months of diagnosis, 72% had a second visit within 3-6 months after the initial visit; of these, 80% had a third HIV medical care visit. Muthulingam et al. (2013) also reported that HIV-infected adults without health insurance were less likely to enter care ($p < .01$).

Summary. Presently, research has shown a significant relationship between having health insurance and entry into care for HIV-infected adults. What is not known is whether there are other factors that may mediate this relationship. The research reported here allows for the assessment of the combined effects of various factors that may contribute to adherence to medical appointments over the long term.

Summary

Presently, there are limited studies utilizing causal models to understand the complex relationships among markers of HIV disease progression, social network, barriers to care, depression and substance abuse on medical adherence among HIV-infected adults in the Southeastern US. The research presented and described here underscores the importance of assessing the effects of multiple psychosocial factors with respect to their influence on medical appointment adherence. For example, the knowledge gained from the study of certain adherence levels (adherent, non-adherent) and antecedent factors may yield critical information with respect to determining how a medical provider or researcher can develop and tailor interventions based on the specific
contributory factors at play. This information can be tailored according to the variable that has the most direct effect based on the medical appointment history adherence level of the client. The client will benefit from having this focused intervention and will gain a sense of trust in their medical provider and be more likely to return for future scheduled medical appointments. The research reported in this study is important for a number of reasons. It builds on the previous body of research concerning adherence to medical appointments and factors that have been implicated in poor adherence. It also provides a clear foundation for further research studies and the testing of interventions to increase adherence.
CHAPTER 3
METHODOLOGY

A growing body of evidence in the field of HIV treatment indicates that there is significance variance in individual adherence to medical appointments for management of their disease, and numerous factors have been associated with such variance. Research evidence, though not always extensive, suggests that the factors of interest in this study, namely HIV disease progression, social network, barriers to care (distance to treatment facility and health insurance), depression and substance abuse, may also account for variance in medical appointment adherence. However, little to none of the current research has focused on understanding the combined and interactive effects of these factors on a client’s behavior concerning medical appointment adherence. These factors may be particularly relevant to scheduled medical healthcare appointment adherence within the HIV-infected population. This study addressed the gaps in the research in this field by exploring the effects of markers for HIV disease progression, social network, distance to treatment facility, health insurance, depression and substance abuse on medical appointment adherence among HIV-infected adults living in the Southeastern US. A causal model of the relationships among these variables based on theory and empirical evidence was tested. Specific hypotheses that were tested include the following:
1) Markers of HIV disease progression have a direct effect on adherence to medical appointments.

2) Markers of HIV disease progression have a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointment behavior through their direct effect on depression and substance abuse.

3) Social network has a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointments through its direct effect on depression and substance abuse.

4) Social network has a direct effect on adherence to medical appointments.

5) Depression has a direct effect on both substance abuse and adherence to medical appointments.

6) Depression has an indirect effect on adherence to medical appointments through its effect on substance abuse.

7) Substance abuse has a direct effect on adherence to medical appointments.

8) Distance to treatment facility has a direct effect on adherence to medical appointments.

9) Health insurance has a direct effect on adherence to medical appointments.

Study Design

The correlational study was a secondary analysis of data from the UAB Center for AIDS Research 1917 HIV Clinic Cohort Database. This database retrieved real-time data collection through a client-server based point-of-care electronic medical record (EMR) system from the 1917 clinic. Data from clients at the 1917 Clinic were collected using a
touch-screen kiosk available in the clinic waiting room and exam rooms, at which clients entered updated information during clinic visits. The client signed in via the touch-screen system each time they arrived at the medical facility for HIV care services, and completed a battery of measures. All clients were oriented and instructed in the use of the touch-screen system prior to their first medical clinic appointment. Additional support from staff members was available for clients who could not read or who had difficulty in completing data entry.

At the initial clinic visit, all clients completed a baseline survey. Baseline information included sociodemographic data, as well as data on social support, depression, and substance abuse. During subsequent visits scheduled approximately every three to six months, measures of depression, alcohol abuse, and other psychosocial variables were completed by clients via the touch-screen data collection system. The database integrated data obtained from client’s electronic medical records and data obtained through the touch-screen data collection system to form the 1917 Clinic Cohort Database from which data were extracted for the study reported here.

Setting

The 1917 Clinic has provided comprehensive core medical and social services to adult HIV-infected clients for more than 24 years (1917 Clinic, 2012). Each new client visit includes laboratory assessment, and appointments with both assigned social work and medical providers.

According to a recent report released by the Alabama Department of Public Health, Jefferson County has the highest prevalence of HIV/AIDS in Alabama; and accounts for 28.5% of the reported number of cumulative HIV/AIDS cases in Alabama.
Currently, 71% of the HIV-infected population in Jefferson County, Alabama are male (Alabama Department of Public Health, 2011). In 2011, the 1917 Clinic provided HIV care to 1535 male clients and 441 female clients (J. Raper, 1917 Clinic Director, personal communication, February 9, 2012).

Sample

The study focused on adults with HIV disease and included both men and women living with the disease who were receiving care at the 1917 Clinic. Criteria for inclusion in the study were: (1) male or female gender, (2) age 19 and older; (3) any client first entering care during the period from 1 July 2009 through 1 July 2011, (4) clients who were currently on any HIV medication regimen and/or had taken HIV medication before, (5) had a recent (within 60 days) CD4 cell count and viral load lab result prior to first medical provider clinical visit, (6) had a complete PHQ-9, AUDIT-C, and ASSIST measurement recorded either 90 days prior to the first medical provider clinical visit, or 90 days after the first medical provider clinical visit. Clients were excluded who were previously enrolled/currently active in any HIV trial drug research program.

An age limit was established due to the fact that the 1917 Clinic only provides care for clients aged 19 and older. According to an analysis conducted by the CDC using an extended back-calculating model from 1997-2006, most new HIV infections occurred among young people under 30 years old than any other age group; this is followed by individuals 30-39 (Centers for Disease Control and Prevention, 2008a). People age 50 and older with HIV also accounted for 15% of new HIV diagnoses. Nearly 24% of the people living with HIV are 50 and older (Centers for Disease Control and Prevention, 2008b).
The rationale for including only those clients entering care during the period from 1 July 2009 through 30 June 2011 was based on several reasons. In order to determine the medical appointment adherence level in all new clients, it was necessary to observe the pattern of adherence to medical appointments over an extended period of time. In this study, the pattern of adherence was observed over a 12-month period starting with the client’s first visit for HIV care at the 1917 clinic during the enrollment period. For example, medical appointment adherence for a client who first entered care on 1 July 2009 was tracked over a twelve month period extending from 1 July 2009 to 30 June 2010. A total of 674 clients had their first medical provider clinical appointment at the 1917 Clinic in the period selected (1 July 2009 through 30 June 2011). Of these, 338 met the inclusion criteria and were included in the sample for the secondary data analysis. Detail of the selection process is presented in Table 2.
Table 2

*Summary of Exclusion of Participants from the Data Set (N=1216)*

<table>
<thead>
<tr>
<th>Inclusion/Exclusion</th>
<th>Number of Inclusions</th>
<th>Number of Exclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial data set</td>
<td>1216</td>
<td></td>
</tr>
<tr>
<td>Enrollment period (1 July 2009 through 1 July 2011)</td>
<td>674</td>
<td>542</td>
</tr>
<tr>
<td>Deceased</td>
<td>656</td>
<td>18</td>
</tr>
<tr>
<td>Never been on/does not require HIV HAART treatment</td>
<td>608</td>
<td>48</td>
</tr>
<tr>
<td>Participated/currently active in HIV trial HAART</td>
<td>598</td>
<td>10</td>
</tr>
<tr>
<td>No recent (within 60 days) completed CD4 cell count or viral load report prior to the first medical provider clinical visit</td>
<td>589</td>
<td>9</td>
</tr>
<tr>
<td>Missing or incomplete PHQ-9, or AUDIT-C, or ASSIST measurement recorded either 90 days prior to the first medical provider clinical visit, or 90 days after the first medical provider clinical visit</td>
<td>338</td>
<td>242</td>
</tr>
<tr>
<td>Total number of final participants</td>
<td>338</td>
<td></td>
</tr>
</tbody>
</table>
Data Collection

Prior to the first medical provider visit, all new clients were required to attend an orientation session at the clinic. During this session, clients were oriented on topics such as the availability of medical services, the structure of the clinic facilities, and a deeper understanding about the use of the touch-screen system for future clinical visits. The clients also met with clinic nurses to complete lab assessments to determine their current CD4 cell count and viral load. The client also completed The Drug Abuse Screening Test (ASSIST) (Skinner, 1982), Alcohol Use Disorder Identification Test (AUDIT-C) (Saunders et al., 1993), and the Patient Health Questionnaire (PHQ-9) (Spitzer et al., 1999). All data collection occurred via the touch-screen system in a private area which automatically entered patient data and updated the client EMR without any intervention from staff members.

As part of the 1917 Clinic’s holistic care effort, the client-server based point-of-care electronic medical record (EMR) system prompted the same sets of measurements every six months for each client. It was assumed that the client would voluntarily complete the provided measurements during their clinic visits. However, not all clients completed the touch-screen entry at each client visit. The information entered by clients into the touch-screen system was reviewed at every medical appointment. As an example, changes in the scores on the measure of depression triggered an alert to staff to complete a more detailed assessment and possible referral for needed treatment/services. One issue complicating the study was the fact that CD4 cell count and viral load measures were not always measured prior to the day of the clinic visit; rather, they were sometimes measured on the same day of clinic visit. In order to capture the most clients with
complete data, a 60-day window for completion of such measures was used (refer Figure 2).

![60 day window diagram](image1)

\[ \text{First medical provider clinical visit} \]

*Figure 2.* Timeline collection process for CD4 cell count and viral load with 60 day window prior to the first medical provider clinical visit.

Similar problems existed for other measures. The investigator made the decision to accept measures of PHQ-9, AUDIT C, and ASSIST completed within plus or minus 90 days of the clinic visit (refer to Figure 3). In situations where multiple measurements were recorded on the same variable during the accepted time period, only the measurement completed closest to the first medical provider clinic visit was utilized.

![90 day window diagram](image2)

\[ \text{First medical provider clinical visit} \]

*Figure 3.* Timeline collection process for PHQ-9, AUDIT-C, and ASSIST with either 90 days prior to the first medical provider clinical visit, or 90 days after the first medical provider clinical visit.
The 1917 Clinic also collects several measurements from their current clients who seek treatment at the facility. Table 3 shows the types of measurements collected at the 1917 Clinic, and the types of measurements selected for this study. Table 4 further provides a summary of all the variables included in this research.
### Table 3

*Types of Measurements Collected at 1917 Clinic*

<table>
<thead>
<tr>
<th>Patient Based Metrics (PBM)</th>
<th>Used in this Study</th>
<th>Data Capture Timeframe¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depression (PHQ)</strong></td>
<td>✓</td>
<td>+/- 3 months of the first medical clinic visit</td>
</tr>
<tr>
<td><strong>Anxiety (PHQ)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ARV Adherence (ACTU-4)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol use (AUDIT-C)</strong></td>
<td>✓</td>
<td>+/- 3 months of the first medical clinic visit</td>
</tr>
<tr>
<td><strong>Drug use (ASSIST)</strong></td>
<td>✓</td>
<td>+/- 3 months of the first medical clinic visit</td>
</tr>
<tr>
<td><strong>Symptoms (HIV-SI)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Quality of life (EuroQOL-5D)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Body Morphology (FRAM)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lab Assessment: CD4, Viral Load**

Grade: ✓ 60 day window prior to the first medical provider clinical visit

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¹Only based on one recorded measurement completed closest to the first medical provider clinic visit
Table 4

Summary of all Variable included in the Study

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>Major Study Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>CD4 Cell Count</td>
</tr>
<tr>
<td>Age</td>
<td>Viral Load</td>
</tr>
<tr>
<td>Gender</td>
<td>Current Living Arrangement</td>
</tr>
<tr>
<td>Highest Education Level</td>
<td>Distance to HIV Treatment Facility</td>
</tr>
<tr>
<td>Income Level</td>
<td>Health Insurance</td>
</tr>
<tr>
<td></td>
<td>Depression PHQ-9 (Patient Health Questionnaire)</td>
</tr>
<tr>
<td></td>
<td>AUDIT-C (Alcohol Use Disorder Identification Test)</td>
</tr>
<tr>
<td></td>
<td>ASSSIST (Alcohol, Smoking and Substance Involvement Screening Test)</td>
</tr>
<tr>
<td></td>
<td>History of 12-Months Medical Appointments</td>
</tr>
</tbody>
</table>
Ethical Considerations

According to the 1917 Clinic protocol, written informed consent was required and completed by each new client entering care at the 1917 Clinic for participation in the clinic’s electronic data collection process associated with their clinical visits. The HIV clinic staff explained to the client how the facility collects, processes, and stores data collected from clients and their medical records and how such data is used in research. Clients are given an opportunity to address concerns and ask questions about the research and they are assured that their medical care will not be affected if they choose not to complete the touch-screen survey during their medical care visits. They are also informed that their name or other identifying information is not included in the data base, where participant identification numbers rather than names are used. They are also assured that data will only be reported at the group level. All data is automatically entered into the 1917 HIV Clinic Cohort Database. The data collection and management procedures for the database have been approved by the Institutional Review Board (IRB) of the University of Alabama at Birmingham.

For the secondary data analysis conducted as part of the present study, the protocol used in abstracting, storing, managing and analyzing the data, was reviewed and approved by the Institutional Review Board (IRB) of the University of Alabama at Birmingham on 27th June, 2012. A copy of the IRB proposal and approval documentation is provided in Appendix A, and approval for project revision/amendment is also provided in Appendix B. The investigator also received approval to examine data from the 1917 HIV Clinic Cohort Database by the Database Principal Investigator Dr. Michael Saag (see Appendix C for a copy of the approval letter).
The investigator received the requested data in a de-identified format downloaded into an “Ironkey” (Ironkey, 2013) protected universal storage bus (USB) drive. Ironkey was used exclusively to store and manage all research data. The Ironkey USB is an ideal method for protection of the data set due to its unique features. Designed by the US military, the Ironkey comes with a built-in identity manager that stores and protects usernames and passwords. If the Ironkey is lost or stolen, there is no possible way that the data can ever be accessed by an outside party. Ironkey is designed to be impenetrable with state of the art security features (IronKey Inc, 2012).

Variable Measures

The data used in the secondary analysis was collected using standard measures which will be discussed in the following section. The variables measured and examined in this study included sociodemographic data, markers of HIV disease progression (specifically, the CD4 cell count and viral load), proxy of social network, distance to treatment facility, health insurance, depression, and drug and alcohol abuse. The outcome variable, adherence to medical appointments, was constructed using available data as explained below.

Adherence to Medical Appointments

At the present time, there is no existing standard operational definition of adherence to medical appointments. The issue is further complicated by the variance in what is considered to be the acceptable time between clinic visits for management of HIV disease. Today it is generally accepted that once individuals enter care, they should return for follow-up visits a minimum of every six months. Thus, each client should, at the
minimum, have three standard medical appointments each year, at baseline, and at six months and 12 months following the baseline appointment (Rana et al., 2010). For the purpose of this study, the definition of appointment adherence was based on the number of medical clinic visits attended divided by the total number of medical appointments scheduled during the 12-month period (Mugavero, 2008).

A client is considered ‘adherent’ when one returns for all scheduled appointments (100%) during a one year period. In contrast, a client is considered non-adherent when missing one or more scheduled appointments (< 100%), during the one year time period. Appointment adherence measurement posed a simple way to capture the overall adherence rate based on a specific time frame, and it has face validity over a long-term period (Mugavero et al., 2010). In contrast, such measurement requires careful documentation in explaining the reasons for cancelled visits (e.g., on vacation, admitted to the hospital, etc.) to have a clear understanding of non-adherence to medical appointments. Additionally it is also important to distinguish between regularly scheduled medical appointments for monitoring the client and those visits due to illness in order to get an accurate adherence rate (Mugavero et al., 2010). In the present study, only regularly scheduled medical appointments were considered in the calculation of adherence.

Demographic Variables

Demographic variables measured include age, race, gender, highest education level, and income level. Age was operationalized based on the year of birth. Race was measured as a categorical variable including categories for Caucasian, African American, Hispanic, and Asian. For the purposes of the data analysis, the race categories were
collapsed into two major categories: non-minority (Caucasian), and minority (African American, Hispanic, and Asian). Gender was categorized as male and female. Highest education level was defined as total years of formal education completed, and treated as a continuous variable. Income level was based on the reported monthly household income.

Markers of HIV Disease Progression

For this study, the markers of HIV disease progression were defined as the most current values available in the EMR based on the current lab assessment report for CD4 cell count and viral load completed within 60 days prior to the first medical clinic visit.

Social Network

For this study, the self-reported living arrangements, as in “living with someone else” (coded as 0) or “living alone” (coded as 1) were used as a proxy measure of social network. While this measure does not give a clear indication of the client’s overall social network, it does give a gross indication of their more personal network.

Barriers to Care

Two types of barriers to care were examined in this study: distance to treatment facility and health insurance status. Distance to treatment facility was defined as the number of miles one resides from the 1917 Clinic as determined by entering the client’s address in the online MapQuest web-based service. The MapQuest website allows any user to determine their driving direction and map services. In this study, distance to the treatment facility was calculated based on the reported client’s resident zip code to the
1917 treatment facility zip code. Categories of health insurance status included “with insurance” (coded as 1), or “without insurance” (coded as 0).

**Depression**

Depression was measured using the Patient Health Questionnaire (PHQ-9) (Spitzer et al., 1999). The PHQ-9 included 9 items that measured signs and symptoms of depression based on the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (Kroenke, Spitzer, & Williams, 2001). The actual PHQ-9 tool is listed under Appendix D. Respondents indicated the frequency and duration of time (over the past 2 weeks) during which they have experienced each sign/symptom on a 4 – point Likert-type format with response ranging from 0 (not at all) to 3 (nearly every day). Items are summed for a total score with a range of 0 to 27, with higher scores indicating a greater number of signs and symptoms. The following cut-points have been recommended: 0 to 4 – clients may not require treatment; 5 to 14 – clinician judgment about treatment based on duration of symptoms and functional impairment; and 15 and greater – treatment warranted using medication, therapy, or a combination of both. The PHQ-9 has been applied and used with thousands of primary care and medical specialty outpatients (Levenson, 2011). The PHQ-9 has been reported to have high internal reliability as evidenced by Cronbach’s alpha of 0.89 reported in the a primary care study, and 0.86 in the PHQ Obstetric Gynecology Study (Kroenke et al., 2001). Unfortunately, the reliability of the PHQ-9 in HIV-infected populations has not been reported in the US at this time. However, the reliability of PHQ-9 has been documented in HIV populations in several other nations. In western Kenya, Monahan et al. (2009) reported a coefficient alpha for a PHQ-9 total score 0.79 and test-retest reliability of 0.59. In Australia, the
reliability of the PHQ-9 scale was 0.93 (Mao et al., 2008). In Malaysia, the Tung, Lee, Ng, Tan, and Kamarulzaman (2009) study reported a Cronbach’s alpha of 0.873.

**Substance Abuse**

Data for substance abuse was captured by two measures, the Alcohol, Smoking and Substance Involving Screening Test (ASSIST) which is a brief assessment of involvement in substance use/abuse, and the Alcohol Use Disorder Identification Test (AUDIT-C) which provided more detailed information about Alcohol use than the ASSIST. Each assessment is described in more detail in the following sections.

*Drug Abuse.* For the purpose of this study drug abuse was conceptually defined as the misuse of prescribed medication or over the counter drugs in excess of directions, and any form of non-medical use of drugs. The various classes of drugs may include, but are not limited to: cannabis such as marijuana, solvents, tranquillizers, barbiturates, cocaine, stimulants, hallucinogens or narcotics (Cocco & Carey, 1998).

In this study drug abuse was measured by the ASSIST developed for the World Health Organization. The ASSIST is a brief screening tool to determine the use of psychoactive substances and it is also designed for implementation in different healthcare settings. This instrument provides information concerning: 1) the substances people have used in their lifetime; 2) the substances they have used in the past three months; 3) problems related to the use of substances; 4) risk of current or future harm in using the related substance; 5) dependency on the substance; and 6) any activity involving injecting drug use (WHO ASSIST Working Group, 2002). The ASSIST provided drug-specific information about current and life-time use by the client. Such information provided an opportunity for the medical provider to further evaluate clients in conjunction with their
current medical treatment by assigning proper biological screenings that will be helpful in the early intervention and treatment process (WHO ASSIST Working Group, 2002). The psychoactive substances covered tobacco, alcohol, cannabis, cocaine, amphetamine type stimulants, sedatives, hallucinogens, inhalants, opioids, and any other drugs deemed detrimental for the current situation. Any clinical setting can tailor and test for the types of substances they want to screen with their clients. The actual ASSIST tool is listed under Appendix E. Detailed explanations of the responses and scores for each question are as follows:

The first ASSIST question measured the life-time use of any listed substances. The listed substances included tobacco products, alcoholic beverages, cannabis, cocaine, stimulants, inhalants, sedatives/hypnotics, hallucinogens, opioids, and ‘other non-medical use drugs’.

There are two alternate responses: “Yes” will be scored as =3, or “No” will be scored as 0. A response to “No” to any listed substance will prompt no further questions, and the measurement is complete. However, an answer of “Yes” to any listed substance will prompt further sets of questions (Question 2 to Question 7), before moving on and completing question 8.

Questions 2 and Question 3 are based on responders recalling the past 3 months experiences with substance-related events. There are five possible responses ranging from 0 to 6, with a score of 0 for “never”, score of 3 for “once or twice”, score of 4 for “monthly”, score of 5 for “weekly”, and a score of 6 for “daily or almost daily”. Question 2 focuses on current usage of any substance for which the client has a history of use while Question 3 explores the possibility of dependency on these same substances.
Questions 4 and Question 5 are also based on the responder recalling events from the previous three months. There are five possible responses for both questions. However, Question 4 scores range from 0 to 7, with a score of 0 for “never”, a score of 4 for “once or twice”, a score of 5 for “monthly”, a score of 6 for “weekly”, and a score of 7 for “daily or almost daily”. Question 4 explores if the responder encountered any health issues, unforeseen social life events, or was involved in legal or financial problems while using the substance listed on question 1. Question 5 scores range from 0 to 8, with a score of 0 for “never”, a score of 5 for “once or twice”, a score of 6 for “monthly”, a score of 7 for “weekly”, and a score of 8 for “daily or almost daily”. Question 5 determines if the responder has not been able to fulfill their role obligations due to the use of substances reported on question 1.

Question 6 through Question 7 has three alternate responses with the score of 0 for “No, never”, score of 6 for “Yes, in the past month”, and a score of 3 for “Yes, but not in the past 3 months”. Question 6 assesses the reactions or responses from the responder’s network in the current use of reported substance. Question 7 also determines the possibility of drug dependency by determining if the responder has the will to cut down or control the use of the reported substance. Question 8 has three alternate responses Likert scale scores from 0 to 2: “No, never, Yes, in the past month”, or “Yes, but not in the past 3 months.” The final question 8 queries the history of the responder in the activity of non-medical drug injecting activities.

ASSIST scores can be evaluated by either a specific substance involvement score or the total substance involvement score. The specific substance involvement score is calculated by adding the responses from Question 2 through Question 7 pertaining to the specific substance. For example, if the responder only uses Cannabis, the scoring should
only focus on the reference for Cannabis from Question 2 through Question 7. The total scores for specific substance involvement range from 0 to 33, and can further be categorized as “low risk” (scores from 0-3), “moderate risk” (scores from 4-26), and “high risk” (scoring 27 and above). However, consumption of alcohol has a wider range score, and can further be categorized as “low risk” (scores from 0-10), “moderate risk” (scores from 11-26), and “high risk” (scoring 27 and above). The total substance involvement score is based on the sum of responses to Question 1 through Question 8 for all ten drug classes.

According to the WHO ASSIST Working Group (2002), the instrument was initially tested in Australia, Brazil, Ireland, India, Israel, the Palestinian Territories, Puerto Rico, the United Kingdom and Zimbabwe. The average reported test-retest reliability coefficients ranged from a high of 0.90 to a low of 0.58 when the subject regretted what was done under the influence of a substance (WHO ASSIST Working Group, 2002). Recently the version of such instruments have been improved and updated, and more verification has been conducted to determine the reliability of the instrument as compared with other standard available scientific measurements on substance abuse.

In 2008, Humeniuk et al. conducted an international multi-site study to validate the updated ASSIST tool. The represented international multi-site nations included Australia, Brazil, India, Thailand, United Kingdom, United States, and Zimbabwe. The research team recruited a total of 1147 substance users, with 697 participants from the primary health care setting, and 350 from specialist drug treatment facilities. All participants were given the ASSIST to complete, in conjunction with eight additional measurements tools: 1) the Addiction Severity Index-Lite (ASI-Lite); 2) the Severity of Dependence Scale (SDS); 3) the MINI International Neuropsychiatric Interview (MINI-
Plus); 4) the Rating of Injection Site Condition (RISC); 5) the Drug Abuse Screening Test (DAST); 6) the Alcohol Use Disorders Identification Test (AUDIT-C); 7) the Revised Fagerstrom Tolerance Questionnaire (RTQ); and 8) the Maudsley Addiction Profile (MAP).

The results from the Humeniuk et al. (2008) study indicated a significant correlation between ASSIST scores and the ASI-Lite ($r = 0.76–0.88; p < 0.001$), SDS ($r = 0.59; p < 0.001$), AUDIT ($r = 0.82; p < 0.001$) and RTQ ($r = 0.78; p > 0.0001$). In addition, the ASSIST scores were also significantly greater for all substance abuse or substance dependent participants with MINI-Plus measurement ($p < 0.001$). Not only ASSIST reported a Chronbach’s alpha of $>0.80$ for the majority of the domains, significant correlations were also observed between ASSIST scores and measures of risk factors for the development of drug and alcohol problems ($r = 0.48–0.76$), which further reinforce the construct validity of ASSIST. Discriminative validity was also established when the ASSIST was able to categorize the participants into three group (substance use, abuse and dependence), based on the MINI-Plus diagnoses. Finally, receiver operating characteristic (ROC) analysis was used to implement the cut-off ASSIST scores for further expansion on “low to moderate” and “moderate to high” risk. Internal consistency for majority of the ASSIST domain was over 0.80. These results reemphasized the validity and reliability of ASSIST, and the rational for using ASSIST when it came to identifying the possibility of substance dependency and substance use.
Alcohol Abuse. For this study, alcohol abuse was defined as a pattern of drinking that may result in harm to one’s health, interpersonal relationships, and/or ability to work. Alcohol is inclusive of: beer, wine, liquor or any other alcoholic beverage (Saunders et al., 1993). Alcohol abuse was measured by the Alcohol Use Disorder Identification Test (AUDIT-C) by Saunders et al. (1993), which is used as a screening tool for possible alcohol abuse. The AUDIT-C consists of 3 items, which are measured on a five-point response format ranging from 0 to 4. The actual AUDIT-C tool is listed under Appendix F. Detailed explanations of the responses and scores for each question are presented in the following (refer Table 5).

The AUDIT-C Items may be summed for total scores. A total score of 8 or higher is considered high-risk for alcohol use disorder. The AUDIT-C has high Cronbach’s alpha of 0.93 and test-retest reliability of 0.81 (Saunders et al., 1993). Many other studies have also explored the psychometrics performance of AUDIT-C with the Cronbach’s alphas ranges from 0.68-0.87 in samples of veterans, general primary care settings, psychiatric settings and the US general population (Bradley et al., 2003; Bradley et al., 2007; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998; Dawson, Grant, Stinson, & Zhou, 2005; Frank et al., 2008; Gordon et al., 2001). In more recent research reported by McGinnis et al. (2012), the research team utilized AUDIT-C to determine risky drinking and unhealthy alcohol use between the HIV-infected and un-infected clients. The result showed that AUDIT-C is valid and reliable in both populations.

In this research, the available data from ASSIST only measured four types of substances: crack or cocaine, amphetamine, opiates, and marijuana. Alcohol abuse was measured by AUDIT-C separately. Therefore, the total substance involvement score was based on the sum of responses to Question 1 through Question 8 for the four drug classes.
The AUDIT-C was based on the total score, with higher scores representing the possibility of higher risk for alcohol use disorder.
Table 5

Summary of Responses and Scores for AUDIT-C

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses and scores</th>
</tr>
</thead>
</table>
| Question 1 | never = 0  
            | monthly = 1  
            | 2-4 times a month = 2  
            | 2-3 times a week = 3  
            | 4 or more times a week = 4 |
| Question 2 | 1-2 standard alcoholic drinks = 0  
            | 3-4 standard alcoholic drinks = 1  
            | 5-6 standard alcoholic drinks = 2  
            | 7-9 standard alcoholic drinks = 3  
            | 10 or more standard alcoholic drinks = 4 |
| Question 3 | never = 0  
            | less than monthly = 1  
            | monthly = 2  
            | weekly = 3  
            | daily or almost daily = 4 |
Data Management and Analysis

Data entry and statistical analysis were performed and maintained using the IBM Statistical Product and Service Solutions (SPSS®) software, version 21.0 with two-tailed tests and an alpha of 0.05 on all tests for statistical significance. For conducting structural equation modeling path analysis, the LISREL version 8.54 was implemented. The data analysis was conducted in several stages.

**Data Management**

First, the screening process was conducted in SPSS. The data set was examined for completeness and accuracy with missing data analysis, outlier analyses, and checking for statistical assumptions performed prior to the analysis phase. The inclusion and exclusion criteria for the study ($N = 338$) were purposely designed to ensure the quality of the data was maintained. No incomplete or missing data was reported on the major study variables. However, SPSS reported that listwise deletion was implemented for one of the sociodemographic variable (Education, $n = 333$). There were 2 outliers reported and recorded under the “distance to treatment facility”. Due to the possibility of the clients managing their care in another state, or they had moved to another state, both sets of data were retained in the analysis. Finally, safety precaution procedures were implemented for securing the data. Several secured data folders were created during the data management process. New files were created with an extension version number for any changes made on the existing raw data. This was a crucial step as it provided an opportunity for the researcher to back track the changes made on the data.
Data Analysis

First, descriptive analyses was conducted for all study variables (sociodemographic, HIV disease progression, social network, depression, substance abuse, and adherence to medical appointments) including statistics to determine the mean, median, ranges and frequencies. Second, the relationships among variables were assessed using Pearson’s correlations, \( t \)-tests, and the Chi-square statistic. Additionally, the internal consistency reliability of scales measured at interval level or higher were assessed for the study sample using Cronbach’s alpha. Variables that were not significantly correlated with the outcome of interest were still included in the SEM. This is because under the direct/indirect relationship in a path analysis, there is a possibility that both variables carried opposite paths (competing signs), and a significant total correlation between variable and the outcome could have canceled out.

Structural Equation Modeling Path Analysis

The primary method used for testing the study hypotheses was structural equation modeling (SEM) path analysis. SEM is a statistical analysis technique that has the same purposes as multiple regression analysis, with the interpretation similar to the regression method; except that in SEM, the relationships among the variables of interests (paths) are tested simultaneously and parse out the direct and indirect effects of variables. The SEM tests the null hypothesis of “no difference” between the hypothesized model and the data; it also tests the hypothesized relationships among study variables. The goal in SEM is to be able to accept rather than reject the null hypothesis; acceptance of the null hypothesis of “no difference” means that the model fits the data and the null hypothesis is confirmed. If the null hypothesis is rejected and the model does not fit the data, the null hypothesis is
rejected, and modifications of the model are needed. Table 6 provides an overview of the SEM process.
Specify a model with path diagram

Show with a path diagram how the variables are believed to be related

Model variables identification

Test whether the variances and covariances fit the model that has been constructed.

Run statistical tests, parameter estimates, and standard errors for the numerical coefficients in the linear equations

Maximum Likelihood Estimation (MLE)

Using the reported statistics, decide if the model generated is a good fit to the data

The minimum fit function Chi-square

Goodness-of-Fit Index (GFI)

Comparative Fit Index (CFI)

Root Mean Square Error of Approximation Index (RMSEA)

Model manipulation

Examine path coefficients to determine if it is good fit, with modification if needed. Determine if data findings support hypothesized relationships among variables.
In this study, SEM was implemented to: (1) explore the relationships among the variables in the path models, and (2) determine the fit of the model with the data. The LISREL software program was used to test the overall fit of the model, as well as to generate path estimates to allow examination of the direct and indirect effects of the model variables on the outcome variables of adherence to HIV medical care appointments. Maximum Likelihood Estimation (MLE) was used to calculate the path coefficients. As indicated by Kline (2005), MLE is the most common method used in exploring the estimated effect path coefficients. However, there are some assumptions that must be made when utilizing the MLE method of estimation in SEM. Assumptions of the MLE includes: 1) having access to a large sample size, 2) all the variables are measured continuously, and 3) all variables are normally distributed.

As related to sample size and power, published SEM applications recommend that in the case of 10 to 15 observed variables a sample size of 200 to 400 is needed (Bacon, Bacon, & Inc, 2001). Loehlin (2004) reported that sample sizes of less than 200 may result in inaccurate path coefficients and underestimate the fit of the model to the data. Kline (2005) recommended that the reasonable sample size for the SEM analysis be determined by having 10 (minimal) to 20 (optimal) subjects for every variable in the model. In a similar vein, Bollen’s rule also suggested that 5-10 participants are needed for every path observed in the SEM model (Kelloway, 1998). In this study, there were a total of 33 observed paths (9 error paths, 9 observed variables paths, and 15 latent paths). There were a total of 338 subjects in this study. Based on the recommendation from several researchers, the minimum requirement for the study was not only met, but exceeded.

Another assumption of the MLE method of estimation in SEM is that all the continuous variables in the model have the characteristics of normal distribution. Having
such characteristics will improve the accuracy of the path estimate. However, Kline (2005) cautions that one should always examine the correlation coefficient in SEM path estimates. In the event where the significance coefficients are too high, the fit indices for the model will be impacted. Therefore, there will be a potential of introducing a Type I error (when a researcher rejects a model that should not have been rejected).

Goodness of Fit Indices

A Goodness of fit test is used in addition to the Chi-Square statistic to determine the fit of the model to the data and whether the null hypothesis should be rejected or accepted. Currently, there are several different statistical indices for determining model fit (Hooper, Coughlan, & Mullen, 2008). Due to the fact that fit indexes only rule out bad models and do not support good fitting models, many researchers suggested the use of multiple indices when determining model fitness (Hoyle, 1995; Jaccard & Wan, 1996; Kline, 2005; Ullman, 1996). For example, Jaccard and Wan (1996) recommended the use of a minimum of three different fit indices before drawing conclusions of the fitness of the model, while Kline (2005) suggested at least four different fit indices be used. In the current study, four different good-of-fit indices were used: (1) the Chi-square, (2) the goodness of fit index (GFI), (3) the comparative fit index (CFI), and (4) the root mean square error of approximation (RMSEA).
**Chi-square**

The chi-square ($\chi^2$) test is the most common fit test embedded in the majority of statistical software (Garson, 2007). Such tests can be used in SEM to determine if the covariance between the variables in the predicted model fit in the observed variable data (Hu & Bentler, 1999). If there is a good fit in the model, the chi-square test should be non-significant. For example, an alpha ($p$-value) of 0.05 on all tests for statistical significance will be implemented in this study. If the chi-square test reported a $p$-value of less than 0.05, the predicted model will be considered failing the fit test, and will be rejected. However, there are some limitations in using the chi-square test.

McIntosh (2007) reported one of the assumptions of the chi-square test is multivariate normality. A situation where the data shows signs of being in a non-normality status (severe deviations from normality), could create false rejections of the model even when the model was properly defined. The Chi-square test also has a sample size limitation. In a large sample size study, chi-square statistics are frequently noted to reject the study models (Bentler & Bonett, 1980; Jöreskog & Sörbom, 1993). Kenny and McCoach (2003) reported that Chi-square tests for sample size above 400 cases are almost noted statistically significant. In contrast, in smaller sample studies, chi-square statistics show a lack of power and the statistic test might not able to discriminate between a good or poor fitting models (Kenny & McCoach, 2003). In this study, Chi-square test was deemed appropriate based on the suggested sample size ranges.
The Goodness of Fit Index (GFI)

The goodness of fit index (GFI) is an alternative to the chi-square test. GFI measures the proportion of the observed variance and covariance of the predicted model (Jöreskog & Sörbom, 1993). The covariance matrix shows the relationship between variables. GFI ranges from 0 to 1. The higher the GFI value, the better the model “fits”. However, MacCallum, Browne, and Sugawara (1996) indicated that as the value of GFI increases, the number of parameters will increase as well, and an upward bias with large sample sizes was also noted in two separate research studies conducted by Shevlin and Miles (1998) and Bollen (1990). Conversely, a downward bias was noted when a large ratio of degrees of freedom was implemented in the sample size (Sharma, Mukherjee, Kumar, & Dillon, 2005). Although Bentler and Bonett (1980) suggested that a GFI value of 0.90 or above was acceptable, due to the sample size limitation as discussed earlier, a GFI value of 0.95 should be considered a good cut-off for good model fit (Garson, 2007; Sharma et al., 2005). For this study, the GFI value of 0.95 was implemented.

Comparative Fit Index (CFI)

The comparative fit index (CFI) is also known as relative fit indices (McDonald & Ho, 2002) or comparative indices (Miles & Shevlin, 2007). CFI fit indices use only a chi-square value to compare with the baseline model. According to McDonald and Ho (2002), the null hypothesis in the relative fit indices model indicated that all variables are uncorrelated with the dependent variable in the model. The CFI is an improved form of indices that is not dependent on the sample size (Bentler, 1990). Rather, the CFI takes into account and adjusts for the sample size (Byrne, 1998; Fan, Wang, & Thompson, 1999; Tabachnick & Fidell, 2008). CFI assumes that the latent variables are uncorrelated
with the dependent variable in the model. The value for CFI range between 0 to 1, with a value of greater than 0.90 indicating a good fit model (Bentler, 1990). Hu and Bentler (1999) proposed that a CFI value of 0.95 or higher should be considered a standard cut-off for good model of fit. For this study, the CFI value of 0.95 was implemented.

The Root Mean Square Error of Approximation (RMSEA)

The root mean square error of approximation (RMSEA) focuses on the difference between the residuals of the sample covariance matrix (observed) and the hypothesized (predicted) covariance model (Steiger, 1990). RMSEA can provide confidence interval data (Kenny & McCoach, 2003). In general, a value of RMSEA of less than 0.05 is desired (Diamantopoulos & Siguaw, 2000). However, values between 0.05 and under 0.08 still indicate a reasonable fit (Browne & Cudeck, 1993; Diamantopoulos & Siguaw, 2000). Hu and Bentler (1999) suggested a RMSEA value of 0.06 as a standard cutoff for an acceptable model fit. Finally, any RMSEA values less than 0.10 are considered a poor fit and should not be accepted (Browne & Cudeck, 1993; Diamantopoulos & Siguaw, 2000).

Study Limitations

There are several methodological limitations of the current study. First, the study was a correlational design. Such design limits inference in causal relationships. It should be mentioned that the research design was only focused on people who were adherent or non-adherent to their scheduled medical appointments during the 12-month period beginning with their first visit for HIV care treatment at the 1917 clinic. This design did not collect data on HIV-infected adult clients who may have missed all scheduled
appointments. The design also did not differentiate the courses of HIV medication treatment. Second, the secondary data analysis was based on self-reported data. One of the limitations of self-reported data is that it cannot be independently verified. In addition, there is the strong possibility of selective memory, specifically when answering questions that rely on recalling how one “experiences” a period of time. Third, the secondary data analysis also restricts the scope of the research as researchers can only address research questions for which data are available in the dataset (Polit & Beck, 2008), specifically with the available choices of variables and measurements in the study. Another limitation of the study was the lack of medical history, in particular CD4 cell count and viral load, for each client. There was significant variance in the HIV medical history of study participants; some were newly diagnosed and just entering care for the first time, while others were transfers transferring their HIV care to the 1917 Clinic (referred by another clinician) or were returning to care after dropping out of care for some time. Lastly, the research only examined the data for a specific 2 year period at one HIV medical facility in the Southeastern US. Therefore, limitations existed in relation to the generalizability of the findings and the sample may or may not have been an accurate representation of the HIV-infected adults living across the United States and globally.

SUMMARY

In summary, a path analysis structural equation modeling (SEM) was implemented to verify the causal model of the relationships among variables based on theory and empirical evidence. Relevant statistical testing such as chi-square fit index was implemented to determine if the proposed model should be accepted or rejected. In
the event where a fit did not occur, modification of the path was conducted through model reduction and modification, an approach commonly called “theory trimming.”

This research project provided both challenges and rewards for not only the clients, but for the researchers as well. Information gathered and presented from this study will offer new insight into understanding the effects of markers for HIV disease progression, social network, depression and substance abuse on medical adherence, specifically in the HIV-infected community. The next chapter discusses the analysis and reports results from the research.
CHAPTER 4
ANALYSIS AND RESULTS

In this chapter, the findings of the research are presented in the following order:
1) a description of the study sample, 2) a detailed evaluation of the study instruments; and
3) the results of the analyses related to the research hypotheses. All analyses were carried
out using IBM Statistical Product and Service Solutions (SPSS®) Version 21, and the
statistical significance level for all analyses was set at a probability level of 0.05. For
conducting structural equation modeling, the LISREL version 8.54 was implemented.

Description of the Sample

Sample of the Demographic Characteristics

Descriptive statistics were used to analyze data of the sample demographic
characteristics. For those demographic variables measured categorically, the frequencies
and percentages of participants in each category are found in Table 7. Demographic
characteristics measured at the interval level are summarized statistically in Table 8.

The ratio between male and female subjects included in the analyses was 5 to 1.
The sample ranged in age from 19 to 71 years, with a mean age of 39.89; the majority of
subjects (33.1%) fell within the age range of 40-49 years. Less than 3.6% of the sample
was age 60 and older. The large majority of subjects were African American (60.7%) and
white (38.8%), with less than 1% of the sample Asian and Hispanic.
As a whole, the sample was quite well educated. Less than 12.3% had not completed at least a high school education, while 59.1% had completed at least some college; 22.2% had earned a bachelor or higher degree. Sixty-three percent of the sample reported a monthly household income of $999, and 34% reported a monthly household income of $499 or less. Although 59.1% of the total sample completed at least some college education, less than 8% of the total sample were making >$2,000 a month. Fifty-one percent of the sample reported having some form of health insurance supplement, either through private or government sources. Forty-nine percent of the sample reported having no form of health insurance. Subjects lived from 1 to 1,048 miles from the clinic. Sixty-one percent of the sample lived within 20 miles of the clinic; however, 26% lived more than 60 miles away.

Description of the Model Variables

Descriptive statistics were used to summarize subjects’ scores on the research variables of interest as represented in the study model to be tested. Subjects’ CD4 cell count at baseline ranged from 1 to 1,254 (M = 363.09, SD = 264.35) with 26% having CD4 cell counts >500 cells/μL. Subjects’ viral load ranged from 1.59 log_{10} to 6.66 log_{10} copies/mL (39 to 4,520,000 copies/mL), with 20% of the study sample having >5 log_{10} copies/mL (100,000.00 copies/mL).

Scores on the PHQ-9 depression measure ranged from 0 to 27 with a mean score of 6.39 (SD = 6.71). Based on cut-points determined in prior research of the PHQ-9, 53.3% of the sample scored less than 4, which is indicative that no treatment is needed, while 32% of the sample scored between 5-14, which indicates requiring further diagnostic assessment by a clinician based on duration of symptoms and functional
impairment. Fifteen percent of the study sample scored higher than 14, indicating treatment required with antidepressants, therapy, or a combination of both treatments.

A majority of subjects recorded living with someone (80.0%), including spouse, partner, family member, relatives, friend, or in a community house setting. The remaining sample (20%) lived alone.

Subject scores on the AUDIT-C alcohol abuse measure ranged from 0 to 12 with a mean score of 2.01 (SD = 2.18). Thirty-one percent of the study sample never consumed any alcohol beverages (score = 0). Twenty percent of the study sample scored higher than 4 on the assessment, indicating a high risk for hazardous drinking or active alcohol use disorders (see Table 7).

Substance abuse was measured by ASSIST, which assessed usage of four commonly abused drugs: crack/cocaine, amphetamines, opiates, and marijuana. Categories of scores for the four substances are provided in Table 7. None of the study subjects scored 27 or higher, which is indicative of a substance abuse pattern accompanied by severe problems with health, social, financial, legal, and relationship issues, as well as the probability of active substance dependency.

Table 9 provides a descriptive history of substances used by the study sample. Current active use (within the past 3 months) by subjects in the study sample were found for marijuana (n = 36), crack or cocaine (n = 22), amphetamines (n = 8) and opiates (n = 4). It is important to point out that some subjects were poly-substance users, such that a total of 41 subjects were actively using one or more substances. Finally, the outcome variable of interest was adherence to HIV medical appointments. For the 12-month study period, 46% of the sample missed one or more medical appointments.
Table 7

*Frequencies and Percentage for Demographic Characteristics of the Sample*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 338</td>
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</tr>
<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
<td>268</td>
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<td>Female</td>
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<tr>
<td>Age</td>
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<td>30-39</td>
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<tr>
<td>Race</td>
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<tr>
<td>Minority (African American/Asian(^1)/Hispanic(^1))</td>
<td>207</td>
<td>61.2</td>
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<tr>
<td>Non-minority (White)</td>
<td>131</td>
<td>38.8</td>
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<tr>
<td>Living Arrangements</td>
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<tr>
<td>Alone</td>
<td>68</td>
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<tr>
<td>Lives with others</td>
<td>270</td>
<td>79.9</td>
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<tr>
<td>Education(^2)</td>
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</tr>
<tr>
<td>8 - 11 years (&lt; high school)</td>
<td>41</td>
<td>12.3</td>
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<tr>
<td>12 years (high school)</td>
<td>94</td>
<td>28.2</td>
</tr>
<tr>
<td>13-20 years (&gt; high school)</td>
<td>198</td>
<td>59.5</td>
</tr>
</tbody>
</table>

\(^1\) Study included only one participant represented from each Asian and Hispanic ethnicity.

\(^2\) N = 333
Table 7 (continued)

*Frequencies and Percentage for Demographic Characteristics of the Sample*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>%</th>
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<tbody>
<tr>
<td><strong>Income (monthly)</strong></td>
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<tr>
<td>&lt;$500</td>
<td>115</td>
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<tr>
<td>$500-$999</td>
<td>98</td>
<td>29.0</td>
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<td>$1,000-$1,499</td>
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<td>&gt;$2,500</td>
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<td><strong>Health Insurance Status</strong></td>
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<td>No Insurance</td>
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<td><strong>Distance to Treatment Facility</strong></td>
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<td>0.1-29.9 miles</td>
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<td>30.0-59.9 miles</td>
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<td>10.1</td>
</tr>
<tr>
<td>&gt;90.0 miles</td>
<td>33</td>
<td>15.7</td>
</tr>
<tr>
<td><strong>CD4 Cell Count</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;200 cells/μL</td>
<td>105</td>
<td>31.1</td>
</tr>
<tr>
<td>200-499 cells/μL</td>
<td>143</td>
<td>42.3</td>
</tr>
<tr>
<td>&gt;500 cells/μL</td>
<td>90</td>
<td>25.7</td>
</tr>
<tr>
<td><strong>Viral Load</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 3.99 (\log_{10}) copies/mL (0-9,999 copies/mL)*</td>
<td>169</td>
<td>50.0</td>
</tr>
<tr>
<td>4 (\log_{10}) - 4.99 (\log_{10}) copies/mL (10,000-99,999 copies/mL)</td>
<td>101</td>
<td>29.9</td>
</tr>
<tr>
<td>&gt; 5 (\log_{10}) copies/mL (100,000 copies/mL)</td>
<td>68</td>
<td>20.1</td>
</tr>
</tbody>
</table>

* one participant recorded a < 40 copies/mL in this category
Table 7 (continued)

*Frequencies and Percentage for Demographic Characteristics of the Sample*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PHQ-9</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4 (Patient may not require treatment)</td>
<td>180</td>
<td>53.3</td>
</tr>
<tr>
<td>5-14 (Clinician judgment about treatment based on duration of symptoms and functional impairment)</td>
<td>107</td>
<td>31.7</td>
</tr>
<tr>
<td>&gt;15 (Treatment warranted using medication, therapy, or a combination of both)</td>
<td>51</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>ASSIST-Crack or Cocaine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-3 (Low Risk)</td>
<td>293</td>
<td>86.7</td>
</tr>
<tr>
<td>4-26 (Moderate Risk)</td>
<td>45</td>
<td>13.3</td>
</tr>
<tr>
<td>&gt;27 (High Risk)</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>ASSIST-Amphetamines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-3 (Low Risk)</td>
<td>273</td>
<td>80.8</td>
</tr>
<tr>
<td>4-26 (Moderate Risk)</td>
<td>65</td>
<td>19.2</td>
</tr>
<tr>
<td>&gt;27 (High Risk)</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>ASSIST-Opiates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-3 (Low Risk)</td>
<td>316</td>
<td>93.5</td>
</tr>
<tr>
<td>4-26 (Moderate Risk)</td>
<td>22</td>
<td>6.5</td>
</tr>
<tr>
<td>&gt;27 (High Risk)</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>ASSIST-Marijuana</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-3 (Low Risk)</td>
<td>245</td>
<td>72.5</td>
</tr>
<tr>
<td>4-26 (Moderate Risk)</td>
<td>93</td>
<td>27.5</td>
</tr>
<tr>
<td>&gt;27 (High Risk)</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

3Low risk of health and other problems from the current pattern of use

4At risk of health and other problems from the current pattern use of substance

5High risk of experiencing severe problems (health, social, financial, legal, relationship) as a result of current pattern use of substance and the possibility of substance dependency
Table 7 (continued)

Frequencies and Percentage for Demographic Characteristics of the Sample

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N = 338</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substance Abuse Interpretation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current(^6)</td>
<td>41</td>
<td>12.1</td>
</tr>
<tr>
<td>Prior(^7)</td>
<td>93</td>
<td>27.5</td>
</tr>
<tr>
<td>Never</td>
<td>204</td>
<td>60.4</td>
</tr>
<tr>
<td>AUDIT-C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (No risk)(^8)</td>
<td>106</td>
<td>31.4</td>
</tr>
<tr>
<td>1-3 (Moderate Risk)</td>
<td>164</td>
<td>48.5</td>
</tr>
<tr>
<td>&gt;4 (High Risk)(^9)</td>
<td>68</td>
<td>20.1</td>
</tr>
<tr>
<td>Medical Adherence Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-99 (Missed medical appointment)</td>
<td>154</td>
<td>45.6</td>
</tr>
<tr>
<td>100 (No missed medical appointment)</td>
<td>184</td>
<td>54.4</td>
</tr>
</tbody>
</table>

\(^6\)Any activity of using cocaine or crack, amphetamine, opiates (non-medical), or marijuana within the past 3 months

\(^7\)Any history of using cocaine or crack, amphetamine, opiates (non-medical), or marijuana not within the past 3 months

\(^8\)No alcoholic beverages consumed

\(^9\)High risk for hazardous drinking or active alcohol use disorders
Table 8

*Descriptive Statistics for Demographic Variables (N=338)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Min.</th>
<th>Max.</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>19.00</td>
<td>71.00</td>
<td>39.89</td>
<td>10.88</td>
</tr>
<tr>
<td>Education$^1$</td>
<td>8.00</td>
<td>20.00</td>
<td>13.09</td>
<td>1.92</td>
</tr>
<tr>
<td>Monthly Income</td>
<td>0.00</td>
<td>4500.00</td>
<td>802.39</td>
<td>747.06</td>
</tr>
<tr>
<td>Distance to Treatment Facility</td>
<td>1.00</td>
<td>1048.00</td>
<td>40.14</td>
<td>79.27</td>
</tr>
<tr>
<td>CD4</td>
<td>1.00</td>
<td>1254.00</td>
<td>363.09</td>
<td>264.35</td>
</tr>
<tr>
<td>Viral Load</td>
<td>1.59 log$_{10}$</td>
<td>6.66 log$_{10}$</td>
<td>5.05 log$_{10}$</td>
<td>5.56 log$_{10}$</td>
</tr>
<tr>
<td>ASSIST-Crack or Cocaine</td>
<td>0.00</td>
<td>26.00</td>
<td>2.05</td>
<td>3.92</td>
</tr>
<tr>
<td>ASSIST-Amphetamines</td>
<td>0.00</td>
<td>26.00</td>
<td>2.25</td>
<td>4.10</td>
</tr>
<tr>
<td>ASSIST-Opiates</td>
<td>0.00</td>
<td>14.00</td>
<td>0.59</td>
<td>1.68</td>
</tr>
<tr>
<td>ASSIST-Marijuana</td>
<td>0.00</td>
<td>25.00</td>
<td>3.85</td>
<td>5.29</td>
</tr>
<tr>
<td>Total ASSIST Score$^2$</td>
<td>0.00</td>
<td>44.00</td>
<td>7.28</td>
<td>8.48</td>
</tr>
<tr>
<td>Total AUDIT-C</td>
<td>0.00</td>
<td>12.00</td>
<td>2.01</td>
<td>2.18</td>
</tr>
<tr>
<td>Total PHQ-9</td>
<td>0.00</td>
<td>27.00</td>
<td>6.39</td>
<td>6.71</td>
</tr>
<tr>
<td>Medical Adherence</td>
<td>0.00</td>
<td>100.00</td>
<td>79.92</td>
<td>29.07</td>
</tr>
</tbody>
</table>

$^1N = 333$

$^2$Based on four types of substance abuse: crack or cocaine, amphetamines, opiates, and marijuana
Table 9

ASSIST Substance History

<table>
<thead>
<tr>
<th>Types of Substances</th>
<th>Current(^1)</th>
<th></th>
<th>Prior(^2)</th>
<th></th>
<th>Never</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Crack or Cocaine</td>
<td>22</td>
<td>6.5</td>
<td>77</td>
<td>22.8</td>
<td>239</td>
<td>70.7</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>8</td>
<td>2.4</td>
<td>63</td>
<td>18.6</td>
<td>267</td>
<td>79.0</td>
</tr>
<tr>
<td>Opiates</td>
<td>4</td>
<td>1.2</td>
<td>29</td>
<td>8.6</td>
<td>305</td>
<td>90.2</td>
</tr>
<tr>
<td>Marijuana</td>
<td>36</td>
<td>10.7</td>
<td>148</td>
<td>43.8</td>
<td>154</td>
<td>45.6</td>
</tr>
</tbody>
</table>

\(^1\)Within the past 3 months

\(^2\)Not in the past 3 months
Instrument Reliability

In general, Cronbach’s alpha values of 0.70 or higher are considered acceptable. Kline (1993) emphasized that while a 0.70 alpha or higher is considered the gold standard, it may not be appropriate for all measures. In fact, Kline argued that Cronbach’s alpha value below 0.7 may be more realistic when there is diversity of the constructs being measured (Kline, 1993). Cortina (1993) also noted that the general guidelines for Cronbach alpha have to be carefully considered, because the value of the alpha depends on the total number of items on the scale.

In this study, internal consistency reliability was assessed for PHQ-9 instrument and ASSIST (crack or cocaine, amphetamine, opiates, marijuana). However, Cronbach’s alpha for AUDIT-C was not assessed because only total scores were obtained, and there is no individual item responses provided from the database.

As shown in Table 10, the reliability estimates for the study sample varied to some extent from those reported by the instrument developers. The Cronbach’s alpha for the PHQ-9 ($\alpha = 0.90$) was higher than the original reliability coefficients ($\alpha = 0.89$) provided by Spitzer et al. (1999). The reliability estimates for the ASSIST subscales are also shown in Table 10. The reliability coefficient for opiates ($\alpha = 0.56$), marijuana ($\alpha = 0.68$), amphetamines ($\alpha = 0.78$), and crack or cocaine ($\alpha = 0.78$).
Table 10

*Internal Consistency Reliability of Instruments*

<table>
<thead>
<tr>
<th>Instruments</th>
<th>Number of items</th>
<th>Cronbach’s Alpha Study</th>
<th>Author¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHQ-9 (Spitzer et al., 1999).</td>
<td>9</td>
<td>0.902</td>
<td>0.89</td>
</tr>
<tr>
<td>ASSIST (WHO ASSIST Working Group, 2002).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Crack or cocaine</td>
<td>8</td>
<td>0.753</td>
<td>&gt;0.80</td>
</tr>
<tr>
<td>• Amphetamines</td>
<td>8</td>
<td>0.783</td>
<td>&gt;0.80</td>
</tr>
<tr>
<td>• Opiates</td>
<td>8</td>
<td>0.557</td>
<td>&gt;0.80</td>
</tr>
<tr>
<td>• Marijuana</td>
<td>8</td>
<td>0.677</td>
<td>&gt;0.80</td>
</tr>
<tr>
<td>AUDIT-C (Saunders et al., 1993)</td>
<td>3</td>
<td>N/A²</td>
<td>0.81</td>
</tr>
</tbody>
</table>

¹Reliability as reported in the instrument author’s original article

²N/A (Not assessed) due to the lack of individual responses information from the database
Findings Related to the Research Hypothesis

The results of the analyses are discussed from two separate perspectives. First, the results were utilized to evaluate the hypothesized relationships among the proposed causal model to determine the adequacy of the proposed model on theoretical terms. Secondly, the results of the testing were further tested for the “goodness of fit” of the model with the data. The last process involved some modification of the model to achieve a “best-fitting” for the proposed model.

Test of Theoretical Relationships

A causal model is a system of hypothesized relationships among the model variables. Within a causal model, a researcher can decompose the correlation among the model variables into different components. For example, one can evaluate the correlations between exogenous and endogenous variables, or between two endogenous variables into different components (Raykov & Marcoulides, 2006). Such techniques allow the researcher to examine the hypothesized structural relationship among the proposed causal model variables individually. A correlation coefficient may be represented in three components: 1) direct effects; 2) indirect effects; and 3) non-causal covariation.

Direct effects are represented in the path diagram with a straight line that goes directly from one variable to another variable. Indirect effects are the effects between two variables that are mediated by one or more variables which are also known as mediating variables. Indirect effects are presented in a sequence of straight lines passing through at least one variable before affecting the endogenous variable. In this section, all calculation
were performed by using LISREL (Jöreskog & Sörbom, 1993) and IBM SPSS (George, 2012).

Table 11 presents a correlation matrix table using defined variables from PRELIS (precursor to LISREL) and served as the data for analysis. Standard Pearson correlations were utilized to assess the relationship between pairs of continuous variables, whereas polychromic correlations were used to estimate variables measured on a dichotomous scale. Such measurement was conducted in SPSS. In addition, maximum likelihood was used because it allowed for all fit indices to be produced (Hoyle, 1995; Jöreskog & Sörbom, 1993; Kelloway, 1998).
### Table 11

**Correlation Matrix Using Defined Variables from PRELIS**

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CD4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Insurance&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.096</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. VL&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.252**</td>
<td>-0.013</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. LS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.022</td>
<td>0.195*</td>
<td>-0.085</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Miles&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.023</td>
<td>-0.016</td>
<td>-0.032</td>
<td>0.008</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. PHQ-9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.016</td>
<td>-0.069</td>
<td>0.007</td>
<td>-0.056</td>
<td>-0.065</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. ASSIST&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.147</td>
<td>-0.105*</td>
<td>0.095</td>
<td>0.135</td>
<td>-0.125</td>
<td>0.149</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. AUDIT-C&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.025</td>
<td>-0.064</td>
<td>-0.050</td>
<td>0.151</td>
<td>-0.027</td>
<td>0.052</td>
<td>0.328</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>9. Adherence&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.006</td>
<td>0.066</td>
<td>0.064</td>
<td>-0.019</td>
<td>0.217*</td>
<td>-0.083</td>
<td>-0.208</td>
<td>-0.014</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**Notes:** CD4 = CD4 cell count; VL = Viral Load; LS = Living Situation; Miles = Distance to Treatment Facility; Insurance = Health Insurance Status; PHQ-9 = Patient Health Questionnaire; AUDIT-C = Alcohol Use Disorder Identification Test; ASSIST = Alcohol, Smoking and Substance Involvement Screening Test; Adherence = Medical Appointment Adherence.

<sup>a</sup>Continuous variable.

<sup>b</sup>Dichotomous variable.

*<sup>p</sup> < .05; **<sup>p</sup> < .01.
**Model Structuring and Analysis**

The following sequential steps in structural equation modeling (SEM) analysis were adopted from Anderson and Gerbing (1988). In the study analysis, a baseline model was first constructed incorporating seven conceptual variables. Each model was constructed with the markers of HIV disease progression (HIV), social network (SOCIAL NETWORK), distance to treatment facility (MILES), and health insurance status (INSURANCE) serving as the exogenous factors. Depression (DEPRESSIVE SYMPTOMS) and substance abuse (SUBSTANCE) were constructed as mediating factors. HIV was a true latent variable consisting of CD4 and viral load indicator variables. SUBSTANCE was another true latent variable consisting of ASSIST and AUDITC indicator variables. All other conceptual variables had only one indicator variable, either using composite scores such as AUDIT-C, or direct measures such as MILES; in the case, these are dummy variables. Finally, HIV medical appointment adherence (ADHERENCE) was constructed as the endogenous factor (refer Figure 4).

The baseline model was specified first in order to verify the validity of the latent variables. In order for a baseline model to be used in the subsequent analyses, all the latent factors need to be free in order to correlate. All the latent variables had significant loadings, indicating that stable latent factors were created. Second, a full causal model was specified with all possible hypothesized paths among model variables identified.

Besides the test of overall model fit, a $t$ test of the significance of each estimated path was also examined. During this stage, the most non-significant paths (below a $t$-value of 1.96) from among the latent variables were removed one at a time. This process was also known as “model trimming”. It is important to point out that each time a non-significant path was removed, the entire model was recalculated. In this interactive
procedure, the trimming process continued until there were no longer any non-significant paths among the latent variables. Once the trimming process was completed, the model was interpreted from the trimmed state (Kelloway, 1998). In LISREL, the completely standardized solution consists of the estimates of the LISREL parameters if the variances of the observed and latent variables show unity. The completely standardized solution can range from (-1) to (+1). It can be interpreted with the same concept of correlations.

According to Hinkle, Wiersma, and Jurs (2003), the larger the correlation coefficient, the better one can understand the relationship between variables. There is a need to emphasize that the correlation does not imply causation. Table 12 provides the summary steps for the trimming process, including the standardized solution for the full causal model. The following 9 specific hypotheses represented in the proposed causal model were tested based on the trimmed model.

1) Markers of HIV disease progression have a direct effect on adherence to medical appointments.

2) Markers of HIV disease progression have a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointment behavior through their direct effect on depression and substance abuse.

3) Social network has a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointments through its direct effect on depression and substance abuse.

4) Social network has a direct effect on adherence to medical appointments.
5) Depression has a direct effect on both substance abuse and adherence to medical appointments.
6) Depression has an indirect effect on adherence to medical appointments through its effect on substance abuse.
7) Substance abuse has a direct effect on adherence to medical appointments.
8) Distance to treatment facility has a direct effect on adherence to medical appointments.
9) Health insurance has a direct effect on adherence to medical appointments.

Model Trimming

Table 13 shows a summary of fit measures of baseline model (the model with all possible paths identified), causal model (original theoretical model to be tested with specific hypothesized relationship), and the trimmed model. An independent model which examined the hypothesis that all variables were uncorrelated, was tested first and rejected, with $\chi^2 (36, N = 338) = 161.07, p < .0005$. Next, the baseline model was tested. The fit results were much improved, with $\chi^2 (13, N = 338) = 16.702, p = .213$; GFI = 0.99; RMSEA = 0.03, and CFI = 0.97. A Chi-square difference test indicated a significant improvement in fit between the independent model and the baseline model, $\chi^2_{\text{diff}} (23, N = 338) = 144.37, p < .0005$, and the baseline model was a better fit with the data, with no changes in other standard fit indices (GFI = 0.99; RMSEA = 0.03, and CFI = 0.99).
Figure 4. Trimmed structural equation model predicting medical appointment adherence (standardized solution). All solid lines represent significant effects ($p < .05$); broken lines indicate proposed non-significant paths.
Table 12

*Summary of Standardized Solution for the Full Causal Model*

<table>
<thead>
<tr>
<th>Observed Variables</th>
<th>Paths</th>
<th>Standardized Solution</th>
<th>Significant Direct Effects ($p &lt; .05$)</th>
<th>Action (Trimmed/Retained from the model)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Markers of HIV Disease Progression (HIV)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depressive Symptoms</td>
<td>.02</td>
<td>No</td>
<td>Trimmed</td>
</tr>
<tr>
<td></td>
<td>Adherence</td>
<td>-.02</td>
<td>No</td>
<td>Trimmed</td>
</tr>
<tr>
<td></td>
<td>Substance</td>
<td>-.14</td>
<td>Yes</td>
<td>Retained</td>
</tr>
<tr>
<td><strong>Social Network</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depressive Symptoms</td>
<td>-.04</td>
<td>No</td>
<td>Trimmed</td>
</tr>
<tr>
<td></td>
<td>Adherence</td>
<td>-.01</td>
<td>No</td>
<td>Trimmed</td>
</tr>
<tr>
<td></td>
<td>Substance</td>
<td>-.17</td>
<td>Yes</td>
<td>Retained</td>
</tr>
<tr>
<td><strong>Distance to Treatment Facility (MILES)</strong></td>
<td></td>
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<tr>
<td></td>
<td>Depressive Symptoms</td>
<td>-.07</td>
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<td>Trimmed</td>
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<tr>
<td></td>
<td>Adherence</td>
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<td>Retained</td>
</tr>
<tr>
<td></td>
<td>Substance</td>
<td>-.12</td>
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<td><strong>Health Insurance (INSURANCE)</strong></td>
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<tr>
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<td>Substance</td>
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<td><strong>Substance</strong></td>
<td>Adherence</td>
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Table 13

**Fit Measures of Baseline, Causal, and Trimmed Models**

<table>
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<tr>
<th>Model Type</th>
<th>$\chi^2$</th>
<th>GFI*</th>
<th>AGFI</th>
<th>PGFI</th>
<th>RMR</th>
<th>RMSEA*</th>
<th>NFI</th>
<th>CFI*</th>
<th>PNFI</th>
<th>RFI</th>
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<td>Baseline model</td>
<td>16.70</td>
<td>0.99</td>
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<td>0.03</td>
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<tr>
<td>Full causal model</td>
<td>16.70</td>
<td>0.99</td>
<td>0.96</td>
<td>0.29</td>
<td>0.03</td>
<td>0.03</td>
<td>0.90</td>
<td>0.97</td>
<td>0.32</td>
<td>0.72</td>
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<tr>
<td>Trimmed model</td>
<td>22.31</td>
<td>0.99</td>
<td>0.97</td>
<td>0.46</td>
<td>0.04</td>
<td>0.01</td>
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</table>

*Selected indices for the study

**Notes:** AGFI = Adjusted Goodness-of-Fit Index; CFI = Comparative Fit Index; df = degree of freedom; GFI = Goodness-of-Fit Index; NFI = Normed Fit Index; PGFI = Parsimony Goodness-of-Fit Index; RFI = Relative Fit Index; RMR = Root Mean Residual; RMEA = Root Mean Square Error of Approximation.

$^1p = 0.213$

$^2p = 0.38$
Hypothesis 1: Markers of HIV disease progression have a direct effect on adherence to medical appointments.

From Table 5, the direct path between markers of HIV disease progression and adherence to medical appointments was not significant ($p > .05$), and the hypothesis was not supported. The direct path between markers of HIV disease progression and adherence to medical appointments was trimmed from the model in subsequent analyses.

Hypothesis 2: Markers of HIV disease progression have a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointment behavior through their direct effect on depression and substance abuse.

Findings did not support that markers of HIV disease have a direct effect on adherence to medical appointments ($p > .05$). However markers of HIV disease progression had a direct effect on substance abuse, with a standardized solution of -.14 and $p < .05$. The relationship was found to be inverse such that as HIV disease progression increased, substance abuse decreased. The findings did not support the hypothesized indirect effect of HIV disease progression on medical appointment adherence through its effects on substance abuse. Thus, the hypothesis was only partially supported and was rejected. In subsequent analyses, the direct path from HIV disease progression to depression was trimmed from the model.
Hypothesis 3: Social network has a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointments through its direct effect on depression and substance abuse.

From Table 5, the direct path between social network and depression was not significant ($p > .05$). However, there was a significant direct effect between social network and substance abuse, with a standardized solution of $-0.17$ and $p < .05$. The relationship was positive such that those living alone were more likely to report substance abuse than those living with others. The hypothesized indirect relationship between social network and adherence to medical appointments through social networks effect on substance abuse was supported. However, the indirect relationship between social network and adherence to medical appointments through depression was not supported. Thus, the hypothesis was only partially supported and thus rejected. The direct path between social network and depression was trimmed from the model in subsequent analyses.

Hypothesis 4: Social network has a direct effect on adherence to medical appointments.

This hypothesis was added after the initial test of the causal model with all possible paths identified. However, the findings indicated that social network did not have a direct effect on adherence to medical appointments ($p > .05$), and thus the hypothesis was not supported. The direct path between social network and adherence to medical appointments was trimmed from the model in subsequent analyses.
Hypothesis 5: Depression has a direct effect on both substance abuse and adherence to medical appointments.

The structural equation modeling shows that depression had no direct effect on substance abuse. However, depression had a direct effect on adherence to medical appointments with a standardized solution of .37 and $p < .05$. The relationship was positive such that as depressive symptoms increased, adherence to medical appointments also increased. The hypothesis was only partially supported and thus was rejected. The direct path between depression and substance abuse was trimmed from the model in subsequent analyses.

Hypothesis 6: Depression has an indirect effect on adherence to medical appointments through its effect on substance abuse.

The findings did not support this hypothesis. Given that depression did not have a direct effect on substance abuse, there could be no indirect effects on adherence to medical appointments through substance abuse. This path was trimmed from the model in subsequent analyses.

Hypothesis 7: Substance abuse has a direct effect on adherence to medical appointments.

Hypothesis 7 was supported by the findings. Substance abuse was found to have a direct effect on adherence to medical appointments, with a standardized solution of -0.17 and $p < .05$. The relationship was negative such that as substance abuse increased, adherence to medical appointments decreased.
Hypothesis 8: Distance to treatment facility has a direct effect on adherence to medical appointments.

Hypothesis 8 was supported by the findings. Distance to treatment facility was found to have a direct effect on adherence to medical appointments, with a standardized solution of 0.20 and \( p < .05 \). The relationship was positive such that the further the distance to treatment facility increased, adherence to medical appointments increased.

Hypothesis 9: Health insurance has a direct effect on adherence to medical appointments.

The direct path between health insurance and adherence to medical appointments was not significant \( (p > .05) \), and thus the hypothesis was not supported. The direct path between health insurance and adherence to medical appointments was trimmed from the model in subsequent analyses.

SUMMARY

Out of the total 9 hypothesis, 7 were non-significant. Hypothesized relationships not supported by the findings were later trimmed from the causal model. The final trimmed model reveals that substance abuse and distance to treatment facility both have a direct effect on adherence to medical appointments. The fully trimmed model also provided a good fit to the observed data, with a reported \( \chi^2 (21, N = 338) = 22.31, p = .38; \) GFI = 0.99; RMSEA = 0.03, and CFI = 0.99. Thus the null hypothesis of no differences was supported. A Chi-square difference test between the baseline model and the trimmed model revealed no significant difference, \( \chi^2_{diff} (8, N = 338) = 5.61, p > .25 \). However, the
coefficient of determination \( R^2 = 0.08 \) for adherence only explains 8% among the variables.
CHAPTER 5
FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of the current study was to explore the individual and combined effects of markers for HIV disease progression, social network, depressive symptoms and substance abuse on adherence to medical appointments among HIV-infected adults living in the Southeastern US. The chapter begins with a discussion of the characteristics of the study sample, the findings related to the hypothesized relationships among the study variables and model fit, and the gathered conclusions related to the study findings. The final section provides implications of the study findings and recommendations for future research and study.

Discussion of the Study Sample

A national HIV surveillance report of data from the 46 states with confidential name-based HIV infection reporting s released in 2013 documents the ongoing change in demographics of the HIV population (Centers for Disease Control and Prevention, 2013). The report showed that females account for 20% and males 80% of all new HIV-infected cases. The same report also showed that the greatest number of new cases annually is highest among African Americans (46%), followed by Caucasians (30%), Hispanics (21%) and Asians (2%). The current study utilized secondary data from one comprehensive HIV Clinic located in the Southeastern US. The 1917 Clinic has provided care to an average of 1,920 clients annually from 2009-2012. The gender of the clinic
population mirrors that reported by HIV Surveillance, with 78% males and 22% females. However, the race/ethnicity of the clinic population is quite different from surveillance data with 46% of the sample Caucasian and all non-whites representing only 54% (J. Raper, 1917 Clinic Director, personal communication, February 15, 2013).

For the study sample, gender was distributed similarly to the clinic population with 79% males and 21% females. However the race/ethnicity of the sample more closely mirrored that of the surveillance report than the clinical population with 61% African American, and 39% white. The age of the study sample ranged from 19 to 71 years, with an average age of 40 years. The differences in the race/ethnicity of the study sample from the clinical population could reflect a trend in the demographics of the clinical population toward increasing numbers of minorities using the services.

The 2006-2007 National HIV Behavioral Surveillance System (2011) reported that only 42% of the HIV-infected population completed high school or an equivalent. The current study sample reported much higher levels of education, with 59.5% of the total sample completing high school or equivalent, and 35.7% of the sample completing at least some level of college coursework. Based the current Department of Health and Human Services poverty guidelines (2013), almost 90% of the sample falls below the poverty level (based on the monthly income reported by the sample). This could explain why 49% percent of the sample reported not having any form of health insurance.

Both the CD4 cell count and viral load are importance indicators of HIV disease progression and HIV-infected individuals quickly learn the importance of their values in monitoring their health status. The CD4 cell count is the strongest predictor of HIV disease progression and survival rates in HIV-infected populations (Egger et al., 2002; Mellors & Munoz, 1997). HIV drug treatment is generally recommended for CD4 cell
counts below 350 cells/mm³ (Panel on Antiretroviral Guidelines for Adults and Adolescents, 2013). There is an inverse relationship between VL and CD4 cell count. In general, higher VL is correlated with lower CD4 cell count because the HIV virus destroys CD4 cells. In this study, all participants were currently on some type of HIV medication regimen and/or had taken HIV medication previously. The CD4 cell count ranged from 1 to 1254 ($M = 363.09$, $SD = 264.35$). Thirty-one percent of the participants had a CD4 cell count of 200/mL cells or less at baseline, and 26% had a CD4 cell count $>500$ cells/mL. Viral load ranged from 1.59 $\log_{10}$ to 6.66 $\log_{10}$ copies/mL (39 to 4,520,000 copies/mL), with 20% of the study sample reported to have $>5$ $\log_{10}$ copies/mL (100,000 copies/mL).

According to the recent 2010 census data, 27% of the US population are living in single households. In several large American cities such as Atlanta, San Francisco, New York, and Washington D.C., singles make up for more than 40% of the households (United States Census Bureau, 2012). In this study, 80% of the subjects reported living with someone; a spouse, partner, family member, relatives, friends, or in a communal housing setting. Twenty percent of the subjects lived alone.

Distance to the clinic from a participant’s place of residence (zip code) was examined. Existing evidence indicates that traveling a shorter distance to HIV treatment reduces treatment burden loads and increases healthcare utilization among (Arcury et al., 2005; Whetten et al., 2006). The distance between the sample residence’s zip code to the treatment facility for this study ranged from 1 to 1048 miles with a mean value of 802.39 ($SD = 747.06$). Sixty-five percent of the sample lived less than 30 miles from the treatment facility. Finally, 26% of the sample lived more than 60 miles from the treatment facility. The need to travel significant distances for HIV treatment can be
expected in the HIV-infected population living in rural settings. Additionally, HIV infected individuals have been found to travel greater distance to treatment sites, even when there may be a treatment site in their local area, because of concerns about HIV-related stigma (Hightow-Weidman, Smith, Valera, Matthews, & Lyons, 2011a). According to the same research, substance abuse and mental health conditions may also play a factor influencing where individuals elect to receive HIV care.

Reported prevalence rates for depression in HIV-infected populations range from 22% to 45%, compared with 15% for the general population (Yun et al., 2005). HIV-infected clients with depression surveyed in several studies reported that upon learning of their HIV seropositive status an onset of depression was triggered (Justice et al., 2004; Kalichman et al., 2002a; Leserman, 2008). In order to gain an understanding of the depressive symptoms in this study, PHQ-9 scores were assessed for each participant. The scores revealed that 32% of the study sample did require clinician judgment about depression treatment based on duration of symptoms and functional impairment. The same instrument also showed that 15% of the study sample required depression medication, therapy, or a combination of both treatments.

According to the National Survey on Drug Use and Health (2010) which covered the years from 2005-2009, 28% of the HIV-infected population aged 12 or older with HIV/AIDS reported having experienced binge alcohol use within the previous month, while 33% acknowledged using illicit drugs within the past month. Sixty percent of the current study sample reported never having used illicit drugs. Similarly, 20% of the study sample were considered at high risk for hazardous drinking or active alcohol use disorders. Only 12% of the study sample were classified as current active substance users (crack or cocaine, amphetamines, opiates and marijuana). However, evidence indicates
that individuals are likely to underreport the use of alcohol and illegal substances suggesting that in-report of such use should be cautiously reported and documented (Delaney-Black et al., 2010). In a recent study, Delaney-Black and colleagues found that of those subjects reporting no substance abuse, 74% tested positive for opiates, and 88% of them tested positive for cocaine.

Research shows that the rate of non-adherence to HIV medical appointments during the first year following diagnosis ranges from 36% to 74% (Bofill et al., 2011; Giordano et al., 2009; Rana et al., 2010; Tripathi et al., 2010). In the current study, 46% of the sample missed one or more medical appointments during the 12-month study period. Such findings are consistent with the findings of previous research.

Discussion of the Internal Consistency Reliability of ASSIST

The measure of substance abuse used in this study, ASSIST, includes subscales that measure use of commonly abused drugs. In this study, the data for four of the subscales was used, and reliability of these subscales were as follows: opiates ($\alpha = 0.56$), marijuana ($\alpha = 0.68$), amphetamines ($\alpha = 0.78$), and crack or cocaine ($\alpha = 0.78$). The reliability coefficients for the study sample are somewhat lower than that reported for other populations ($\alpha > 0.80$ were reported for all four types of substances) by the WHO ASSIST Working Group (2002). The difference in the reliabilities for the study sample could be due to a number of reasons. The design of the instrument was such that, it is possible that substance use was underreported in such a way that there was little variance in subject responses to items, and this decrease in variance could have affected the instrument reliability.
Discussion of the Study Findings

Hypothesis 1

*Markers of HIV disease progression have a direct effect on adherence to medical appointment behavior.*

Hypothesis 1 was not supported. As presented in Chapter 2, the current evidence of the relationship of markers of HIV disease progression, such as CD4 cell count and VL, to medical appointment adherence is inconclusive. Findings from the study indicate that there is no relationship between the construct markers of HIV disease progression on adherence to medical appointments. In this study, the pattern of adherence was observed over a 12-month period starting with the client’s first visit for HIV care at the 1917 Clinic during the enrollment period. It is important to point out that the majority of the clients were recently diagnosed with HIV, and might not yet fully understood the relevance of CD4 cell count and viral load to HIV disease progression.

Elizabeth Kubler-Ross (1969) proposed a 5 stage grieving model involving denial, anger, bargaining, depression, and acceptance. The grieving process varies from person to person, and it could be especially long if one has never experienced bereavement. Konkle-Parker, Amico, and Henderson (2011) conducted a semi-structured interview with 130 participants in exploring barriers and facilitators in engagement in HIV care in the southern US. The study found that 74% of the sample reported “denial of their current HIV diagnosis” as the main reason for not engaging in HIV care.

In this study, the subject could be in the stage of denial about the diagnosis of HIV and are still in the early stage of bereavement where avoidance and denial reign supreme. When using avoidance and denial in coping with emotional distress, individuals may avoid any situation or individual who reminds them that they are in fact infected.
with HIV. Thus the subjects in this study may be reluctant to know their CD4 count and viral load, and even more reluctant to attend medical appointments because they are harsh reminders of their HIV status. This could be a possible reason why there is no direct effect of HIV disease progression on adherence to medical appointments.

_Hypothesis 2_

Markers of HIV disease progression have a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointment behavior through its direct effect on depression and substance abuse.

Hypothesis 2 was only partially supported. Kalichman et al. (2002b) reported that clients who experienced increases in VL reported a significant increase in depression symptoms. The research team further noted that a major reduction in depressive symptoms was noted among participants who experienced decreases in viral load to undetectable levels. In another longitudinal cohort study, Ickovics et al. (2001) came to a similar conclusion finding that chronic depressive symptoms were associated with low or declining CD4 cell counts, suggesting that chronic depression may be a common response to evidence of HIV disease progression.

In this study, the findings indicate that markers of HIV disease progression have no direct effect on depression, a finding that is inconsistent with previous research. A possible explanation for lack of a significant relationship was that participants in the study might not have understood the significance of the markers of HIV disease progression for their well-being, and ultimately may not have had a direct effect in depression.
Another explanation could be the possibility that participants in the current study had a long history of depression and the diagnosis of HIV disease and subsequent information about HIV disease progression may not have had any additional effect on one’s depression. Presently, an estimated 1 in 10 U.S. adults report depression (Centers for Disease Control and Prevention, 2010). In the state of Alabama, there is an increased prevalence of depression, representing 14% of the adult population.

The remainders of the pathways were supported. As hypothesized, the findings support the direct effect of markers of HIV disease progression on substance abuse, and also the indirect effect of markers of HIV disease progression on adherence to medical appointments through its direct effect on substance abuse.

There is evidence in support of a direct relationship between markers of HIV disease progression and substance abuse. Hampton et al. (2010) conducted a cross sectional study to explore how individuals cope with their serostatus (HIV positive versus HIV negative). The research team reported that 64% of the HIV-positive clients had a greater likelihood of participating in illicit substance use and abuse as compared with HIV-negative participants. However, the study did not specifically explore the relationship of VL and CD4 cell count to substance abuse.

The current study findings indicated that the relationship between markers of HIV disease progression and substance abuse was negative, such that as disease progression values are higher, substance abuse scores are lower. Based on the theory of stress and coping (Folkman & Lazarus, 1988), this finding is counterintuitive, as one would expect that as HIV disease progresses, substance abuse would also increase as an attempt to manage the emotional distress that may accompany evidence of disease progression. If HIV disease progression is appraised by the individual as a threat to their well-being as
Folkman and Lazarus proposed, the greater the perceived threat, the more individuals will experience high levels of psychological distress and implement coping strategies that are emotion-focused and aimed at decreasing their emotional distress. Emotion-focused coping strategies commonly used include avoidance and denial, as well as the use of substance such as food, drugs, and alcohol as means of medicating the pain experienced in response to threat. Based on Folkman and Lazarus model, we would expected that disease progression may be perceived as threatening and therefore may increase the use of drugs and other substances as a means of coping with the threat. Further research is needed in order to understand the relationship of HIV disease progression to substance abuse.
Hypothesis 3

Social network has a direct effect on depression and substance abuse and an indirect effect on adherence to medical appointment behavior through its direct effect on depression and substance abuse.

Hypothesis 3 was only partially supported.

The Direct Effect of Social Network on Depression

In this study, the current living arrangement as in “living alone” or “living with someone” was used as a proxy measure of engagement in a social network. Current literature shows that social network is a dimension of social support, and perceived availability of support from social networks is associated with a greater use of available mental health services, and more importantly, a reduction in depression symptomology (Stewart et al., 2005). In a separate peer intervention for HIV medical care adherence study, Ownby (2010) found that a greater quality of network support was associated with lower levels of depression for all participants. Thus the findings of the current study are counterintuitive in that social network (living alone versus living with others) had no direct effect on depression.

There are a number of possible explanations for this finding. First, the measure of social network was limited to whether subjects lived with others or alone, yet nothing about the quality of the relationships of those with whom they lived. Living with others may be dictated by financial necessity rather than a mutual bond or affection one would expect to see in supportive relationships. Another possible explanation may be generational differences in social networks. Based on the study analysis, 80% of the study sample indicated that they lived with someone, while 20% of the study sample lived alone. The mean age and years of completed school time among the study
participants was 40 years old, and 13.09 years respectively. It is reasonable to imply that the study participants overall, were educated, and had experienced many life events.

It is reasonable to conclude that because of the age of the sample, participants in this study may rely more on technology supported social network than face-to-face networks. The alternatives discussed above could explain why current living arrangement either “living alone” or “living with someone else” does not have a direct effect on depression. However, the remainder of the relationships proposed in the hypothesis were supported. Social network was found to have a direct effect on substance abuse, and an indirect effect on adherence to medical appointment behavior through its direct effect on substance abuse.

The Direct Effect of Social Network on Substance Abuse

As hypothesized, Social Network had a direct effect on substance abuse. The findings indicate that subjects who lived alone participated in greater substance abuse as compared with subjects who lived with others. In turn, substance abuse had a direct negative effect on missed medical appointments.

Research shows that persons who live with someone (family, relatives, common house, partner) have fewer drug abuse problems across their lifespans (Apel & Kaukinen, 2008; Cuffe, McKeown, Addy, & Garrison, 2005; Dube et al., 2003; Jinks & Raschko, 1990; Pope, Wallhagen, & Davis, 2010). For example, Herttua, Martikainen, Vahtera, and Kivimäki (2011) conducted a population based cohort study to understand the relationship of living arrangements with alcohol related mortality. Their finding indicated that living alone is associated with a substantially increased risk of alcohol dependency and resulting alcohol-related mortality. Research that focuses on the availability of social
support in the HIV-infected community also concurred that social support influences the substance abuse rate. The more one perceived the availability of social support, the less one would become involved in the activity of substance use and abuse (Larios et al., 2009; Mosoko et al., 2011; Wohl et al., 2011). The findings from the current study support the importance of social support in living arrangements.

**Hypothesis 4**

*Social network has a direct effect on adherence to medical appointment behavior*

Hypothesis 4 was not supported. The findings from this study indicated that the type of living arrangement does not have a direct effect on adherence to medical appointments as hypothesized. One explanation for this finding is that there are other factors more important to adherence to medical appointments than social network. Such factors as available transportation, perceived stigma, and the quality of the relationship with their providers are possible factors that may play a greater role in adherence to medical appointments than social network. As previously noted, the limitations of the measure of social network used may have prevented finding a significant relationship even if one existed. Further research is needed to fully explore the role that social support may play in adherence to medical appointments.
Hypothesis 5 and Hypothesis 6

Depression has a direct effect on both substance abuse and adherence to medical appointments.

Hypothesis 5 was only partially supported. Since depression has no direct effect on substance abuse, there is no indirect effect along the same path. Hypothesis 6 was not supported. Additionally, the hypothesized direct relationship between depression and adherence to medical appointments was supported. The finding of a positive relationship between depression and adherence to HIV medical appointments was counterintuitive and in contrast to previous findings.

Research evidence supports an association between depressive symptoms and non-adherence to HIV medication, missed medical appointments, and health status deterioration with HIV disease progression (Cook et al., 2004; Nancy et al., 2004; Weiser et al., 2006; Yun et al., 2005). However, the findings did not support the hypothesized indirect relationship between depression and adherence to medical appointments through substance abuse. The findings suggest that depression’s impact on adherence to medical appointments is direct and not mediated by substance abuse, but rather may be mediated by other unknown factors. That the effect of depression on adherence to medical appointments is primarily direct, this supports the relative importance of depression to adherence.

However, the positive relationship between depression and adherence to medical appointments indicating that as depression increases so does adherence to medical appointments, was not expected. Because depression is associated with fatigue, and negative cognitions, one would expect that adherence would be more difficult with depression. However there are possible explanations for this finding. The 1917 clinic is a
unique facility as it not only provides comprehensive care in mental health services and social services, but also has created linkage to other subspecialties (i.e., neurology, endocrinology, cardiology, dermatology, and palliative care). In addition, the clinic provides psychiatric and counseling services. During each appointment, participants are screened for depressive symptoms, and if such symptoms exist are immediately referred for further evaluation and treatment. Therefore subjects experiencing depressive symptoms may be motivated to attend HIV medical appointments as they know their depressive symptoms will be assessed and treated if needed. The staff members in the 1917 clinic are well trained to address depressive symptoms. Another explanation could be the nature of the relationship between these subjects and their HIV medical providers. At the 1917 clinic, clients see the same medical provider, social worker and nurse during each visit. Such an arrangement may foster the development of a long term, trusting relationship between the medical provider team and the client. This could also be a reason why the person with higher depressive symptoms adheres to their medical appointments.
Hypothesis 7

*Substance abuse has a direct effect on adherence to medical appointments.*

Hypothesis 7 was supported by the findings. Subjects reporting substance abuse had poorer adherence to HIV medical appointments than subjects not substance abusing. These findings are consistent with the findings of other studies (Giordano et al., 2009; Kissinger et al., 1995; Mugavero, 2008; The Health Resources and Services Administration, 2006).

In this study, 69% of the study sample reported a moderate to high risk of alcohol abuse. However, only 12% of the study sample were classified as current active substance users (crack or cocaine, amphetamines, opiates and marijuana). Unlike use of illicit substances, consumption of alcohol is not considered an illegal act. Alcohol beverages are widely available from most stores and convenience centers. Participants tend to be more willing to report alcohol consumption as compared with used of illicit drug. Even with the possibility of under-reporting of illicit substance use, this study still supports that substance abuse has a direct effect on medical appointment adherence.
Hypothesis 8

*Distance to treatment facility has a direct effect on adherence to medical appointments.*

Hypothesis 8 was supported by the findings and distance to treatment was found to have a direct effect on adherence to medical appointments. However the nature of the relationship between distance to treatment facility and adherence to medical appointments was positive, indicating that as distance to treatment facility increased, adherence to HIV medical appointments also increased. This finding was counterintuitive as it was expected that greater distance to treatment would be associated with poorer adherence.

This finding is inconsistent with available evidence. Various researchers have reported geographic distance as a barrier in seeking medical care treatment (Cuffe et al., 2005; Deribe et al., 2008; Geng, Nash, et al., 2010; Mosoko et al., 2011; Plitt et al., 2009). Interestingly, the findings from the current study showed otherwise.

The average distance from a subjects’ area of residence to treatment was 40 miles, with a sample range from 1 mile to 1048 miles. A majority (65%) of the sample reported having to travel less than 30 miles to seek HIV care.

Possible explanations for the finding that greater distance for HIV care with increased adherences in medical appointments includes the stigma associated with HIV disease and the deficit of HIV treatment facilities in rural areas of the state of Alabama. People infected with HIV are constantly confronted with stereotypes and rejection in their personal lives, their community, and in society. Stigma has always being a challenging issue for the HIV-infected population not only locally, but worldwide (Amico et al., 2007; Courtenay-Quirk et al., 2006; Goffman, 1963; Peretti-Watel, Spire, Pierret, Lert, & Obadia, 2006). People are willing to travel long distances to seek HIV-related care just to
conceal their HIV status. The fear of being stigmatized is a powerful concern (Wasti, Simkhada, Randall, Freeman, & van Teijlingen, 2012). The decision to seek care outside their home community may also represent a commitment to staying in care. The same may be true for those individuals who seek care at the 1917 clinic because there are no treatment facilities in their local area. The decision to travel to access HIV care may also represent a high commitment to care and thus could explain the higher level of adherence in this subgroup.

_Hypothesis 9_

*Health insurance has a direct effect on adherence to medical appointments.*

_Hypothesis 9 was not supported by the findings._ In this study, the ratio between participants who have health insurance versus participants without health insurance was approximately 1 to 1. For those who have health insurance, accessing HIV care should not be a barrier. Many researchers have concluded that health insurance is the key in enabling one to access to HIV care (Deribe et al., 2008; MacPhail et al., 2007; Mugavero, Lin, Willig, et al., 2009). However, for those who do not have health insurance, other options must be considered. Individuals without health insurance are able to receive HIV care at the 1917 clinic at little to no cost.

The 1917 clinic receives the Ryan White HIV/AIDS Treatment Modernization Act funding which allows the clinic to provide access to care for low-income, uninsured and under-insured HIV infected adults since 1999. In 2010, the clinic received awards totaling $1,927,263 for the Ryan White Part B & C funding (1917 Clinic, 2010). This could be the reason why health insurance status does not influence medical appointment adherence in this study.
Other Findings

The Relationship of Distance to Treatment Facility to Substance Abuse

In the process of using SEM to test the study model, all possible relationships were identified and tested. Although not hypothesized in the original model, some unexpected relationships were supported. The finding from the current study in relation to medical appointment adherence noted some unexpected outcome from the study participants. For example, the path analysis showed that participants who live closer to the treatment facility tend to record a higher score in ASSIST assessment, as compared with participants who live further away from the treatment facility.

One explanation could be that people who live in rural areas might not have as much access to illicit substances. Additionally, the conservative values and norms commonly found in rural communities may influence the lifestyle of the participants in relation to substance abuse. Unlike metropolitan areas, one cannot easily walk into any store and purchase alcohol, and the possibility of buying illicit substances is also higher.

In 2008, the Substance Abuse and Mental Health Services Administration (SAMHSA) conducted a national survey on drug use and health. The administration reported that the rate of current illicit drug use among persons aged 12 or older was higher among residents of large metropolitan counties, with the highest rate of illicit drug use (8.5 percent), followed by nonmetropolitan (8.1 percent), and rural counties (6.3 percent) (Substance Abuse and Mental Health Services Administration, 2008). The same report also indicated that cocaine and marijuana use among the younger age group are higher in urban areas as compared with rural areas.
An interesting finding was the inverse relationship between health insurance and substance abuse. Participants who abuse substances are not as likely to have and maintain health insurance. The average annual health insurance premium in the state of Alabama per person varies according to the age, gender, county of residency, health status and medical history of the prospective client. Recently, a phone call was made to Blue Cross Blue Shield of Alabama customer service in order to obtain a health insurance premium quote. The types of existing conditions and lifestyle determine the rate of the health insurance. A healthy non-smoking man in his 40’s will spend approximately $315 per month, an anticipated annual premium of $3780 annually; while an HIV-infected male in his 40’s will spend $1065 per month, totaling $12,780 per year (Sheryl, personal communication, February 22, 2013).

Based on the demographic data gathered from the study, 63% of the study sample reported a monthly household income totaling less than $1000. With the limited monthly income, it may be difficult for one to pay for private health insurance. However, many of the low income individuals with HIV qualify for other public sources of health care coverage; what is relevant is that substance abusers appear to be less likely to take advantage of these sources of health care coverage.
Conclusion

The hypothesized causal model, which was based on Lazarus and colleagues theory of psychological stress and coping, did not fit the data. However, all but two of the theoretical relationships were supported. As hypothesized, distance to treatment facility and depression were found to have direct positive effects on adherence to medical appointments such that as distance to treatment and depression increased, adherence to medical appointments also increased. Substance abuse was found to have a direct negative effect on adherence such that those subjects reporting substance abuse were more adherent to medical appointments than those who did not report substance abuse. The hypothesized role of depression in mediating the relationship between the antecedent variables of HIV disease progression and social network and the outcome variable adherence to medical appointments was not supported. However, the hypothesized role of substance abuse in mediating the relationships between the antecedent variables of HIV disease progression and social network and the outcome of adherence to medical appointments were supported. Social network had a positive direct effect on substance abuse such that those living alone reported more substance abuse than those living with others. Additionally, the indicators of HIV disease progression (CD4 cell count and viral load), had a direct negative effect on substance abuse such that as disease progression increased, substance abuse decreased. The remaining hypotheses were not supported. Although not hypothesized, both health insurance and miles to treatment were observed to have a direct negative effect on substance abuse, such that those with health insurance and living greater distances from care were less likely to report substance abuse than those without health insurance and living closer care. Finally, only small amounts of variance in the outcome variable were accounted for by the model. This could indicate
that future research should include more variables, specifically sociodemographic variables, which were not the main focus in this study.
Implication

In the current study, among all variables examined, substance abuse played a major mediating role in adherence to medical care appointments. However, although depressive symptoms were found to have a direct effect on adherence to medical appointments, the evidence did not support the hypothesized mediating role of depression. The finding from the study shows that depression was positively related to adherence to medical appointments. This finding was unexpected and inconsistent with previous research.

There are factors not measured that could imply the relationships between depression and adherence to medical appointments. Such factors include any depressive symptoms treatment or counseling by the participants. Because the 1917 Clinic provided an in-house psychiatry/mental health services and uses depression screening as the baseline measurement and provided linkage to related treatment, the relationships between depression and adherence to medical appointments may have been attenuated by such treatments. As compared to other clinic settings where such intervention and treatments may not have been available, the finding may be different. Therefore, the study needs to be replicated with other HIV-infected populations in the Southeastern US who do not receive treatment at a comprehensive HIV clinic, such as the 1917 Clinic.

The study findings also support the need to identify and treat substance abuse among HIV-infected adults as a means of improving adherence to medical appointments. It is important to note that the antecedent variables examined in this study all had indirect effects on adherence to HIV medical appointments through their effect on substance abuse, indicating that substance abuse is an important mediator of adherence to HIV medical appointments that can buffer the potential benefits of antecedent resources such
as social support. Further research is needed to tease out the complex relationships represented in the study model, using the best and most valid and reliable measures of the antecedent and mediator variables.
Recommendations

Based on the findings and conclusions from this study, the following suggestions are recommended for future study before nursing interventions can be recommended:

1) That the study be replicated with other age groups, particularly older HIV-infected adults.

2) That the hypothesized relationships be examined using multiple measures of variables across multiple time points in a longitudinal study. This will enable researchers to more clearly understand how the variables relate across time and context.

3) A qualitative study be conducted to explore what motivates individuals to adhere to their medical appointments.

4) That effort be made to examine the role that the provider-patient relationship may play in medical appointment adherence.

5) That the research model be expanded to include additional antecedent variables in an effort to account for greater degrees of variances in the outcome variables.

6) That the revised model generated through the specification search be tested with another data set.
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APPENDIX A

IRB APPROVAL LETTER
UAB’s Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on January 24, 2017. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator: NG, YEOW CHYE
Co-Investigator(s):
Protocol Number: X12612008
Protocol Title: The Effects of Social Support, Depression, and Substance Abuse on Medical Appointment Adherence of HIV-Infected Men

The IRB reviewed and approved the above named project on 6-27-12. The review was conducted in accordance with UAB’s Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.
IRB Approval Date: 6-27-12
Date IRB Approval Issued: 6-27-12

Marilyn Doss, M.A.
Vice Chair of the Institutional Review Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.
APPENDIX B

IRB PROJECT REVISION/AMENDMENT APPROVAL FORM
Project Revision/Amendment Form

In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.
- Federal regulations require IRB approval before implementing proposed changes. See Section 14 of the IRB guidelines for investigators for additional information.
- Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.

1. Today's Date 9/14/12

2. Principal Investigator (PI)
   Name (with degree) Ng Yow Chye
   Department Nursing
   Office Address PO BOX 305 Toney, AL 35773
   E-mail ngy@uab.edu
   Contact person who should receive copies of IRB correspondence (Optional)
   Name Dr. Linda Moneyham
   E-mail moneyham@uab.edu
   Phone (205) 934-3485
   Office Address (If different from PI) NB202D, 1720 2nd Avenue, So.Birmingham, AL 35294-1210

Blazer ID ngy
Division (If applicable) Office Phone Fax Number

3. UAB IRB Protocol Identification
   3.a. Protocol Number X120612008
   3.b. Protocol Title The effects of HIV status, social networks, depression, and substance abuse on medical appointment adherence of HIV-infected men
   3.c. Current Status of Protocol—Check ONE box at left: provide numbers and dates where applicable
      - Study has not yet begun
      - In progress, open to accrual
      - Enrollment temporarily suspended by sponsor
      - Closed to accrual, but procedures continue as defined in the protocol (therapy, intervention, follow-up visits, etc.)
      - Closed to accrual, and only data analysis continues
   Date closed:
   Number of participants receiving interventions:
   Number of participants in long-term follow-up only:
   Number of participants, data, or specimens entered:

4. Types of Change
   Check all types of change that apply, and describe the changes in Item 5.c. or 5.d. as applicable. To help avoid delay in IRB review, please ensure that you provide the required materials and/or information for each type of change checked.
   □ Protocol revision (change in the IRB-approved protocol)
   In Item 5.c. if applicable, provide sponsor's protocol version number, amendment number, update number, etc.
   □ Protocol amendment (addition to the IRB-approved protocol)
   In Item 5.c. if applicable, provide funding application document from sponsor, as well as sponsor's protocol version number, amendment number, update number, etc.
   □ Add or remove personnel
   In Item 5.c. include name, title/degree, department/division, institutional affiliation, and role(s) in research, and address whether new personnel have any conflict of interest. See "Change in Principal Investigator" in the IRB Guidebook if the principal investigator is being changed.
   □ Add graduate student(s) or postdoctoral fellow(s) working toward thesis, dissertation, or publication
   In Item 5.c. (a) identify these individuals by name, (b) provide the working title of the thesis, dissertation, or publication; and (c) indicate whether or not the student's analysis differs in any way from the purpose of the research described in the IRB-approved HSP (e.g., a secondary analysis of data obtained under this HSP).
   □ Change in source of funding; change or add funding
   In Item 5.c. describe the change or addition in detail, include the applicable OSP proposal number(s), and provide a copy of the application as funded (or as submitted to the sponsor if pending). Note that some changes in funding may require a new IRB application.

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05/26/2012 Page 1 of 3

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5. Description and Rationale

In Item 5.a. and 5.b. check Yes or No and see instructions for Yes responses.

**5.a. Are any of the participants enrolled as normal, healthy controls?**

Yes ☒ No □

**5.b. Does the change affect subject participation, such as procedures, risks, costs, location of services, etc.?**

Yes ☒ No □

If yes, FAP-designated units complete a FAP submission and send to fap@uab.edu. Identify the FAP-designated unit in Item 5.c.

For more details on the UAB FAP, see www.uab.edu/fap.

**5.c. Protocol Changes:** In the space below, briefly describe—and explain the reason for—all change(s) to the protocol:

- In consultation with my dissertation committee and the 1917 Clinic Cohort Database Team, the following changes are being made to the study protocol:
  - The study sample will now include data for both men and women.
  - The following variables will also be included in the data set that will be analyzed:
    - Patient Background (newly diagnosed patient, transferred patient, or re-engaged patient)
    - Income level
    - Insurance status
    - Distance to treatment facility (using patient zip code)
    - Employment status
    - Type of medical provider (Nurse Practitioner or MD)
    - CD4 count
    - Viral load
    - ARV Adherence
    - HIV Symptom Index

All these variables are already included in the 1917 Clinic Cohort Data base and will be included in the data set that will be used in the analyses. (See attachment for more detailed information.)
6.d. Consent and Recruitment Changes: In the space below, 
(a) describe all changes to IRB-approved forms or recruitment materials and the reasons for them; 
(b) describe the reasons for the addition of any materials (e.g., addendum consent, recruitment); and 
(c) indicate either how and when you will reconsent enrolled participants or why reconsenting is not 
necessary (not applicable for recruitment materials).

Also, indicate the number of forms changed or added. For new forms, provide 1 copy. For revised 
documents, provide 3 copies: 
- a copy of the currently approved document (showing the IRB approval stamp, if applicable) 
- a revised copy highlighting all proposed changes with "tracked" changes 
- a revised copy for the IRB approval stamp.

In this research utilizing secondary data analysis, the author is seeking approval for inclusion of additional variables from the 1917 Clinica Cohort Database to include in the secondary data analysis. Please refer to the attachment.

<table>
<thead>
<tr>
<th>Signature of Principal Investigator</th>
<th>Date</th>
<th>9/14/12</th>
</tr>
</thead>
</table>

**FOR IRB USE ONLY**

- Received & Noted
- Approved Expedited*
- To Convened IRB

<table>
<thead>
<tr>
<th>Signature (Chair, Vice-Chair, Designee)</th>
<th>Date</th>
<th>10-2-12</th>
</tr>
</thead>
</table>

D.O.L.A. (6-21-12)

- Change to Expedited Category: Y / N / NA

*No change to IRB's previous determination of approval criteria at 45 CFR 46.111 or 21 CFR 50.111
APPENDIX C

LETTER OF SUPPORT
June 8, 2012

Ycow Chye Ng, CRNP
C/o Dr. Linda Moneyham, PhD, RN, FAAN
Senior Associate Dean for Academic Affairs
University of Alabama at Birmingham
School of Nursing
1720 2nd Avenue, South, NB202D
Birmingham, AL 35294-1210

Dear Mr. Ng,

I am very pleased to support your request for the use of 1917 HIV Cohort database for your secondary data analysis dissertation entitled, “The Effects of Social Support and Substance Abuse on Medical Appointment Adherence of HIV-infected Men.” As the Principal Investigator on record for this protocol (CNICS 0702), I am aware of the need to explore medical appointment adherence issues among our patient attending the 1917 clinic. If there is any other way that the 1917 Clinical Cohort group can assist you in your endeavor, feel free to contact me. I look forward to working with you on this project in the coming months.

Sincerely,

Michael S. Saag, MD
Jim Straley Chair in AIDS Research
Director, Center for AIDS Research

256 Blevin Biomedical Research Building
845 19th Street South
205.934.2437
Fax 205.934.1640

The University of Alabama at Birmingham
Mailing Address:
8998 25A
1530 3rd Avenue South
Birmingham, AL 35294-2170
APPENDIX D

PATIENT HEALTH QUESTIONNAIRE (PHQ-9)
**PHQ-9 Patient Questionnaire**  
Nine symptom checklist

Patient Name: ___________________________  Date: ________

Dear Patient,
In an effort to provide the highest standard of care and meet the requirements of your insurance company, we ask that you fill out the form below. This form is used as both a screening tool and a diagnostic tool for depression. Your provider will discuss the form with you during your visit. Thank you for your cooperation and the opportunity to care for you.

1. Over the *last 2 weeks*, how often have you been bothered by any of the following problems?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Not at all (0)</th>
<th>Several days (1)</th>
<th>More than half the days (2)</th>
<th>Nearly every day (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Little interest or pleasure in doing things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Feeling down, depressed, or hopeless.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Trouble falling/staying asleep, sleeping too much.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Feeling tired or having little energy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Poor appetite or overeating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Feeling bad about yourself – or that you are a failure or have let yourself or your family down.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Trouble concentrating on things, such as reading the newspaper or watching television.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Moving or speaking so slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Thoughts that you would be better off dead or of hurting yourself in some way.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. If you checked off any problem on this questionnaire so far, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

<table>
<thead>
<tr>
<th>Difficulty Level</th>
<th>Not difficult at all</th>
<th>Somewhat difficult</th>
<th>Very difficult</th>
<th>Extremely difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

THE ALCOHOL, SMOKING AND SUBSTANCE INVOLVEMENT SCREENING TEST (ASSIST)
A. WHO - ASSIST V3.0

INTERVIEWER ID ___________________________________________ COUNTRY _______ CLINIC _______

PATIENT ID _______________________________________________ DATE _______

INTRODUCTION (Please read to Patient)

Thank you for agreeing to take part in this brief interview about alcohol, tobacco products and other drugs. I am going to ask you some questions about your experience of using these substances across your lifetime and in the past three months. These substances can be smoked, swallowed, snorted, inhaled, injected or taken in the form of pills (show drug card).

Some of the substances listed may be prescribed by a doctor (like amphetamines, sedatives, pain medications). For this interview, we will not record medications that are used as prescribed by your doctor. However, if you have taken such medications for reasons other than prescription, or taken them more frequently or at higher doses than prescribed, please let me know. While we are also interested in knowing about your use of various illicit drugs, please be assured that information on such use will be treated as strictly confidential.

NOTE: Before asking questions, give ASSIST Response Card to patient

Question 1
(if completing follow-up please cross check the patient's answers with the answers given for Q1 at baseline. Any differences on this question should be queried)

In your life, which of the following substances have you ever used? (NON-MEDICAL USE ONLY)

<table>
<thead>
<tr>
<th>Substance Description</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Tobacco products (cigarettes, chewing tobacco, cigars, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>b. Alcoholic beverages (beer, wine, spirits, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>c. Cannabis (marijuana, pot, grass, hash, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>d. Cocaine (coke, crack, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>e. Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>f. Inhalants (nitrous, glue, petrol, paint thinner, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>g. Sedatives or Sleepings Pils (Valium, Serenax, Rohypnotol, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>h. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>i. Opioids (heroin, morphine, methadone, codeine, etc.)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>j. Other - specify:</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Probe if all answers are negative: "Not even when you were in school?" If "No" to all items, stop interview.
If "Yes" to any of these items, ask Question 2 for each substance ever used.
**Question 2**

*In the past three months, how often have you used the substances you mentioned (FIRST DRUG, SECOND DRUG, ETC)?*

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or Twice</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or Almost Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Tobacco products (cigarettes, chewing tobacco, cigars, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>b. Alcoholic beverages (beer, wine, spirits, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>c. Cannabis (marijuana, pot, grass, hash, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>d. Cocaine (coke, crack, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>e. Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>f. Inhalants (nitrous, glue, petrol, paint thinner, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>g. Sedatives or Sleeping Pills (Valium, Serepak, Rohypnol, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>h. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>i. Opioids (heroin, morphine, methadone, codeine, etc.)</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>j. Other - specify:</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

*If "Never" to all items in Question 2, skip to Question 5.*

*If any substances in Question 2 were used in the previous three months, continue with Questions 3, 4 & 5 for each substance used.*

**Question 3**

*During the past three months, how often have you had a strong desire or urge to use (FIRST DRUG, SECOND DRUG, ETC)?*

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or Twice</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or Almost Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Tobacco products (cigarettes, chewing tobacco, cigars, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>b. Alcoholic beverages (beer, wine, spirits, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>c. Cannabis (marijuana, pot, grass, hash, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>d. Cocaine (coke, crack, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>e. Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>f. Inhalants (nitrous, glue, petrol, paint thinner, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>g. Sedatives or Sleeping Pills (Valium, Serepak, Rohypnol, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>h. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>i. Opioids (heroin, morphine, methadone, codeine, etc.)</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>j. Other - specify:</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
### Question 4

**During the past three months, how often has your use of (FIRST DRUG, SECOND DRUG, ETC) led to health, social, legal or financial problems?**

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or Twice</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or Almost Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Tobacco products</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>b. Alcoholic beverages</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>c. Cannabis (marijuana, pot, grass, hash, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>d. Cocaine (coke, crack, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>e. Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>f. Inhalants (nitrous, glue, petrol, paint thinner, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>g. Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>h. Hallucinogens (LSD, acid, mushrooms, PCP, Speedal K, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>i. Opioids (heroin, morphine, methadone, codeine, etc.)</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>j. Other - specify:</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

### Question 5

**During the past three months, how often have you failed to do what was normally expected of you because of your use of (FIRST DRUG, SECOND DRUG, ETC)?**

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or Twice</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily or Almost Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Tobacco products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Alcoholic beverages</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>c. Cannabis (marijuana, pot, grass, hash, etc.)</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>d. Cocaine (coke, crack, etc.)</td>
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<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>e. Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)</td>
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<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
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<td>7</td>
<td>8</td>
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<td>g. Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)</td>
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<td>7</td>
<td>8</td>
</tr>
<tr>
<td>j. Other - specify:</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>
Ask Questions 6 & 7 for all substances ever used (i.e., those endorsed in Question 1)

Question 6

Has a friend or relative or anyone else ever expressed concern about your use of (FIRST DRUG, SECOND DRUG, ETC.)?

<table>
<thead>
<tr>
<th>Substance</th>
<th>No, Never</th>
<th>Yes, in the past 3 months</th>
<th>Yes, but not in the past 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a. Tobacco products (cigarettes, chewing tobacco, cigars, etc.)</strong></td>
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<td>3</td>
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<td><strong>b. Alcoholic beverages (beer, wine, spirits, etc.)</strong></td>
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<td><strong>c. Cannabis (marijuana, pot, grass, hash, etc.)</strong></td>
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<td><strong>h. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)</strong></td>
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<td>3</td>
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<td><strong>i. Opioids (heroin, morphine, methadone, codeine, etc.)</strong></td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>j. Other – specify.</td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

Question 7

Have you ever tried and failed to control, cut down or stop using (FIRST DRUG, SECOND DRUG, ETC.)?

<table>
<thead>
<tr>
<th>Substance</th>
<th>No, Never</th>
<th>Yes, in the past 3 months</th>
<th>Yes, but not in the past 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a. Tobacco products (cigarettes, chewing tobacco, cigars, etc.)</strong></td>
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<td>6</td>
<td>3</td>
</tr>
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<td><strong>c. Cannabis (marijuana, pot, grass, hash, etc.)</strong></td>
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<td>3</td>
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<td>6</td>
<td>3</td>
</tr>
<tr>
<td>j. Other – specify.</td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
**Question 8**

<table>
<thead>
<tr>
<th>Have you ever used any drug by injection? (NON-MEDICAL USE ONLY)</th>
<th>No, Never</th>
<th>Yes, in the past 3 months</th>
<th>Yes, but not in the past 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**IMPORTANT NOTE:**

Patients who have injected drugs in the last 3 months should be asked about their pattern of injecting during this period, to determine their risk levels and the best course of intervention.

**Pattern of Injecting**

- **Once weekly or less** or Fewer than 3 days in a row
- **More than once per week** or 3 or more days in a row

**Intervention Guidelines**

- Brief intervention including "risks associated with injecting" card
- Further assessment and more intensive treatment

**How to calculate a specific substance involvement score.**

For each substance (labelled a to j) add up the scores received for questions 2 through 7 inclusive. Do not include the results from either Q1 or Q8 in this score. For example, a score for cannabis would be calculated as: Q2c + Q3c + Q4c + Q5c + Q6c + Q7c

Note that Q5 for tobacco is not coded, and is calculated as: Q2a + Q3a + Q4a + Q6a + Q7a

<table>
<thead>
<tr>
<th>The type of intervention is determined by the patient’s specific substance involvement score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Record specific substance score</strong></td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>a. tobacco</td>
</tr>
<tr>
<td>b. alcohol</td>
</tr>
<tr>
<td>c. cannabis</td>
</tr>
<tr>
<td>d. cocaine</td>
</tr>
<tr>
<td>e. amphetamine</td>
</tr>
<tr>
<td>f. inhalants</td>
</tr>
<tr>
<td>g. sedatives</td>
</tr>
<tr>
<td>h. hallucinogens</td>
</tr>
<tr>
<td>i. opioids</td>
</tr>
<tr>
<td>j. other drugs</td>
</tr>
</tbody>
</table>

**NOTE:** Further assessment and more intensive treatment may be provided by the health professional(s) within your primary care setting, or, by a specialist drug and alcohol treatment service when available.
APPENDIX F

THE ALCOHOL USE DISORDER IDENTIFICATION TEST (AUDIT-C)
AUDIT-C Questionnaire

Patient Name _________________________________ Date of Visit ________________

1. How often do you have a drink containing alcohol?
   □ a. Never
   □ b. Monthly or less
   □ c. 2-4 times a month
   □ d. 2-3 times a week
   □ e. 4 or more times a week

2. How many standard drinks containing alcohol do you have on a typical day?
   □ a. 1 or 2
   □ b. 3 or 4
   □ c. 5 or 6
   □ d. 7 to 9
   □ e. 10 or more

3. How often do you have six or more drinks on one occasion?
   □ a. Never
   □ b. Less than monthly
   □ c. Monthly
   □ d. Weekly
   □ e. Daily or almost daily

AUDIT-C is available for use in the public domain.