2008-01-01

Health Locus of Control in HIV: Healthy Individuals with Low CD4 Cells versus an HIV-positive Comparison Group

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HEALTH LOCUS OF CONTROL IN HIV: HEALTHY INDIVIDUALS WITH LOW CD4 CELLS VERSUS AN HIV-POSITIVE COMPARISON GROUP

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A THESIS

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements of
the degree of Master of Science

Coral Gables, Florida

December 2007

UNIVERSITY OF MIAMI

A thesis submitted in partial fulfillment of
the requirements for the degree of
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KUHN, RACHEL (M.S., Psychology)
Health Locus of Control in HIV: (December 2007)
Healthy Individuals with Low CD4 Cells
Versus an HIV-Positive Comparison Group

Abstract of a thesis at the University of Miami.

Thesis supervised by Dr. Gail Ironson.
No. of pages in text. (113)

Research examining multidimensional health locus of control (MHLOC) beliefs in HIV-positive individuals is limited. While studies in numerous other medical populations have shown relationships between MHLOC and markers of protected health status, no other studies, to our knowledge, have done so in HIV. The MHLOC has four subscales: Internal, Chance, Doctors, and Other People. Each subscale measures the degree of belief that one's health is controlled by one of these four constructs. This study compared the MHLOC beliefs of a rare group of healthy HIV-positive individuals with very low CD4 cell counts (below 50) who were not taking HARRT (HLC group), to a group of HIV-positive individuals in the mid-range of disease progression (matched control (MC) group). Two hundred forty-seven diverse participants with HIV completed MHLOC scales as part of a psychosocial battery. Seventy participants from a larger "control" group (N = 177) were matched one-to-one with a participant from the HLC group (N = 70) on four demographic variables (gender, education, ethnicity, and income). The HLC group was found to have significantly lower Internal control beliefs and higher Doctor beliefs in comparison to the MC group. An examination of MHLOC beliefs within each group showed that for both groups, Doctor beliefs were strongest, followed by Internal, Chance and Other People beliefs. Compared to the MC group, individuals

with protected health status (HLC group) were more likely to have a combination of "high" Doctor and "low" Internal beliefs and less likely to have a combination of "low" Doctor and "high" Internal beliefs. Finally, affective depression approached significance as a mediator in the relationship between Doctor control beliefs and group status (HLC vs. MC group). Specifically, protected health status was related to higher Doctor beliefs and lower affective depression. Study limitations and implications are discussed.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Introduction

Approximately 39 million people are currently infected with human immunodeficiency virus (HIV) around the world, and an estimated 2.8 million people are dying from acquired immunodeficiency syndrome (AIDS) each year (UNAIDS Report on the Global AIDS epidemic, 2006). As the HIV/AIDS epidemic continues to be one of the biggest public health crises of our time, researchers in various domains are increasingly aiming their efforts at understanding and preventing this disease. Medical science has made significant advances in providing powerful medications (e.g. highly active antiretroviral therapy, or HAART) that have extended the average life expectancy of HIV positive individuals. Concurrently, researchers in the social sciences, namely Health Psychology and Behavioral Medicine, have been trying to understand the psychosocial factors that can play a role in improving quality of life for HIV positive individuals, as well as in preventing the spread of this disease. As there is significant variation in the rate of progression to AIDS and length of survival for HIV positive individuals, psychosocial factors have been looked at in this context as well. This study will investigate one particular psychosocial construct, health locus of control, in the context of HIV disease progression and health status.

Before the first human case of HIV was diagnosed, a set of psychological measurement scales, known as the Multidimensional Health Locus of Control (MHLOC) was being developed. Based on the locus of control construct from Rotter's Social Learning Theory (Rotter, 1954), the purpose of this measurement tool is to examine the beliefs that individuals have about where control over their health lies. The MHLOC

scales have now been validated and used to study relationships with various health and psychosocial factors in myriad populations, including HIV positive individuals.

The present study assesses health locus of control in HIV positive individuals, and relates it to healthy survival in a rare group of individuals with very low CD4 cell counts who are asymptomatic without the aid of protease inhibitors. It will be argued that certain MHLOC profiles will be related to asymptomatic survival with AIDS. Before presenting the specific hypotheses of this study, it is important to examine health locus of control and how it is related to health and HIV. Therefore, a review of the literature will be done on the following topics: 1) development of and measurement issues with the MHLOC scales, 2) the MHLOC scales in HIV/AIDS as well as other medical populations, and 3) psychosocial factors in HIV disease progression.

Development, Validity and Reliability of the MHLOC Scales

The Multidimensional Health Locus of Control scales (MHLOC; Wallston, Wallston, & DeVellis, 1978) have been important self-report instruments in the study of health behavior for nearly three decades. Numerous efforts at the time of the development of the Multidimensional Health Locus of Control (MHLOC) and even quite recently have looked at the validity and reliability of these scales. Over the course of its existence the MHLOC has undergone many adaptations and revisions, and is in fact still being refined today. The MHLOC scales have been used to gain a better understanding of health behavior in various populations, including general non-clinical populations and medical populations.

A review article by Wallston & Wallston (1978) provides a backdrop to the development of the MHLOC, including an explanation of how it was based on the locus

of control construct that is part of Rotter's Social Learning Theory (Rotter, 1954). The MHLOC is used to look at an individual's beliefs about where control over their health lies. An individual regarded as having an internal locus of control about their health believes that their own behavior influences their health status. An individual regarded as having an external locus of control about their health believes that their health is controlled by the actions of important other people, doctors, and/or is due to chance, fate or luck. Based on initial research, individuals with internal control appeared more likely to engage in healthy behaviors (Wallston & Wallston, 1978).

Currently, there are several forms of the MHLOC scales in use by researchers and clinicians. The original Forms A and B of the MHLOC were designed to be interchangeable, and are comprised of three subscales: the internal HLOC subscale, and two external subscales, "powerful others" (e.g., the belief that family, friends and medical professionals influence their health status) and "chance" (e.g., beliefs that fate, luck, or chance influence their health status) (Wallston & Wallston, 1978). The Children's Health Locus of Control scale (CHLOC) was adapted from Forms A and B for use in child populations (Parcel & Meyer, 1978). Form C was developed later as a condition-specific measure of MHLOC for individuals with a particular illness or medical condition (Wallston, Stein, & Smith, 1994). Most recently, a God HLOC scale was developed as an adjunct to the MHLOC in order to further break down the "powerful others" external subscale to separate beliefs about God's control over health from beliefs about additional powerful others' control over health (Wallston, Malcarne, Flores, Hansdottir, Smith, Stein, et al., 1999). The evolution of the MHLC scales makes it easy to conceive of further additions and adaptations in the future.

The present study will examine the MHLOC scales (Form C) in a group of HIV positive individuals. First, a description of the development and measurement of the original MHLOC scales (Forms A and B) will provide background information on this construct. Next, a review of the literature on Form C MHLOC will provide a thorough description of the measurement tool used in this study.

A preliminary study during the development of the Health Locus of Control (HLOC) scales looked at health-related information seeking in undergraduate college students (Wallston, Maides, & Wallston, 1976). As predicted, results showed that students with internal locus of control beliefs and high health value scores sought more health information than any other group (Wallston, et al., 1976). This team of researchers followed with two validation studies where HLOC was shown to have discriminant validity in comparison to Rotter's Internal-External Control Scale with a group of college students and a group of women in weight reduction programs (Wallston, Wallston, Kaplan, & Maides, 1976).

The HLOC developed into the Multidimensional Health Locus of Control (MHLOC) as reported in a study aimed at determining if the reinforcement of health behaviors are driven by three factors—internal, matters of chance, and the control of powerful others (Wallston, Wallston, & DeVellis, 1978). This study served as a foundation for initial internal consistency and validity of the two equivalent forms of the MHLOC, Forms A and B. The adequate psychometric properties of Wallston's original MHLOC scales were established in a study with medical and surgical patients: Cronbach's alpha was .63 for items measuring internal HLOC and .56 for items measuring external HLOC (chance and powerful others, combined as one factor in

analysis), and the two-factor solution met criteria for simple structure, parsimony, and psychological meaningfulness (Meyers, Donham, & Ludenia, 1982). A comparison between MHLOC and another measure of health locus of control beliefs, the Lau-Ware scale, showed minimal convergence validity between the two, most likely due to the poor internal consistency reliability of the Lau-Ware scale (Marshall, Collins, & Crooks, 1990). This information appears to add to the conclusion that Wallston's MHLOC is the most valid measure of health locus of control to date.

A study with clinical (diabetes patients) and non-clinical populations was designed to investigate the original three-factor construct versus a proposed two-factor construct for Forms A and B MHLOC (Talbot, Nouwen, & Gauthier, 1996). Results indicated that the original three-factor construct was more valid than the two-factor construct for both populations. Another notable finding from this study was a difference in the function of HLOC for the clinical and non-clinical groups. Specifically, for individuals with a chronic illness a high internal HLOC did not exclude the possibility of a high external HLC simultaneously. In contrast, the non-clinical population individuals with high internal HLOC appeared to have a lower external HLOC (Talbot, Nouwen, & Gauthier, 1996). Interestingly, the findings from this study were obtained while a new form of MHLOC (Form C) was already being developed to address differences in clinical and non-clinical populations.

Cultural and ethnic diversity is another important issue pertaining to the measurement of the MHLOC scales. This topic was addressed by Stein, Smith and Wallston (1984) who suggest the need for research looking at environmental characteristics possibly influencing the development of HLOC expectancies. A study

with Ghanaian adolescents examined the cross-cultural correspondence of the MHLOC scales, and found support for several aspects of its validity and internal consistency reliability for this population (Astrom & Blay, 2002). Other recent work looking at the measurement of MHLOC presents an overview of current research showing ways in which scores may differ across countries and cultures (Luszczynska & Schwarzer, 2005). For example, one study found that African-American women with breast cancer have stronger beliefs in chance and powerful others than Caucasian women with breast cancer. Another point regarding ethnicity and MHLOC is that in some cultures, strong religiosity may have a "ceiling effect" involved in the lack of connections between the MHLOC scales and health-related outcomes. Finally, it is noted that in countries where a high sense of individualism is favored, high internal HLOC might be more related to better health and healthier behaviors than in countries where a high sense of collectivism is favored (Luszczynska & Schwarzer, 2005).

Somewhat contradictorily, a lack of differences in MHLOC scores based on ethnic group has been found in at least one other study. Very few significant relationships between ethnicity-related variables and MHLOC scores was found in a study comparing three ethnic groups (Caucasian Americans, Filipino Americans and Latino Americans) represented in a college student population (Malcarne, Fernandez, & Flores, 2005). However, this study was limited in merely showing whether the factor structure created based on theories relevant to one ethnic group (Caucasians, the majority group) can be replicated in other groups. Malcarne, Fernandez and Flores (2005) propose the need to "start at the drawing board" by taking into consideration any constructs that represent other (minority) ethnic groups that may be entirely missing from the original

forms of MHLOC. Perhaps this theory explains the lack in significant findings based on ethnicity in this study.

A recent special issue of the Journal of Health Psychology highlights several articles presenting new insight on the MHLOC, and indicates the growing body of research and interests regarding this topic. Masters and Wallston (2005) found that by using canonical correlations, several relationships appeared between MHLOC scales and other important variables related to health behavior, including coping, affect and health values. The article discusses the importance of using multivariate methods to gain a better understanding of the interplay between MHLOC and other psychological constructs in an effort to more accurately portray their synchrony found in the real world (Masters & Wallston, 2005).

An overview article on the construct and measurement of the MHLOC scales brings into question points related to the clinical utility of the current constructs (Luszczynska & Schwarzer, 2005). First brought forth is the idea that the MHLOC is applied to a whole condition or disease in a way that is too general. An outcome- or behavior-specific MHLOC (e.g., related to pain, disability, medication adherence) is suggested as possibly providing information more relevant to medical practice. Secondly, they note that specific MHLOC profiles have not yet been related to healthy behaviors, and until they are, the clinical implications are limited. Finally, evidence is presented showing the construct of self-efficacy related to health to be a better measure than MHLOC for the purpose of predicting health behavior change (Luszczynska & Schwarzer, 2005).

The further refinement of the MHLOC into a form including strategy (beliefs that the 'means' in question can produce the desired or undesired 'ends' or outcomes over which control is exerted) and capacity beliefs (access to the means in question) was proposed and then validated by correlations with existing measures of health-related control constructs (Baken & Stephens, 2005). In another study, the need to consider various 'means' of control (ways in which control may be exerted,) was established based on a comparison of several models concluding that a model measuring different external means separately showed the best fit. This article also cautions that although it may be important to further break down the external means of control (i.e., "friends" and "family" instead of just "powerful others"), a theoretical approach is important to avoid proliferation leading to "unwieldy" measurement tools (Baken & Stephens, 2005).

Finally, a comprehensive breakdown of the validity of the MHLOC scales is provided in a recent article by Wallston (2005). In this article, Wallston presents a review of evidence for face, content, criterion-related, discriminant, and construct validity for Forms A and B of the MHLOC.

Wallston, Stein, and Smith's (1994) presentation of Form C of the MHLOC scales addresses the fact that the original Forms A and B were purposefully created with the intention of not being specific to any one health behavior or health condition. Research in the field presented evidence that locus of control beliefs may correlate in a different way with health behaviors and measures of health status when about a specific condition in contrast to more general locus of control beliefs. It is pointed out that people with chronic illnesses may have better health outcomes with higher external HLOC, which is in line with the findings of Talbot, Nouwen & Gauthier (1996). Forms A and B failed to

incorporate illness affects into the construct, making interpretation difficult for medical populations, and contributing to the demand for a new form of MHLOC. Therefore, Wallston, Stein, and Smith (1994) developed Form C as a condition-specific locus of control scale that could be easily adapted for use with any medical or health-related condition. One construct feature in Form C is the addition of a "Doctors" subscale to the Chance and Powerful Others subscales of external HLOC, notably indicating a departure from the construct of Forms A and B. These researchers provide evidence for the reliability and validity of Form C MHLOC in their article (Wallston, et al., 1994); a detailed description of this information will be presented in the Methods section of this paper.

Several factors demonstrating the validation of Form C of MHLOC are also presented in Wallston's recent article (2005). Concurrent validity (a form of criterion-related validity) was shown when the subscales correlated with theoretically matched subscales of Form B MHLOC. Known-groups validity was evidenced in numerous ways—for example, patients with diabetes had higher internal HLOC scores than patients with chronic pain, cancer, or rheumatoid arthritis. A set of findings was also used to show convergent validity, for example, the Other People subscale was positively related to helplessness. Also, construct validity was supported when a behavioral pain management program resulted in increased internal HLOC scores for chronic pain patients as was theoretically predicted. Final evidence for construct validity in Form C was supported by its more thorough explanation of the unique variance in the pain ratings of arthritis patients in comparison with Form B (Wallston, 2005). Overall, evidence

clearly exists to substantiate the use of Form C MHLOC as a valid and reliable measure of health locus of control beliefs in medical populations.

Health Locus of Control and HIV/AIDS

MHLOC and Physical Health Factors in HIV/AIDS. Much of the current research looking at the role of MHLOC in people living with HIV and AIDS has focused on the relationships of this construct with other psychosocial factors, while a few studies have looked at the relationships with physical health factors. One study with HIV positive homosexual men included MHLOC with several other measures to assess the maintenance of hope in this population (Rabkin, Williams, Neugebauer, Remien, & Goetz, 1990). Results showed that higher internal HLOC was negatively associated with hopelessness, and external HLOC was positively related to hopelessness—in other words, participants who believed they controlled their own health had higher levels of hope. Additionally, this study found no relationship between hope/hopelessness and physical status, as measured by physical symptoms associated with HIV and T cell subset assessments, in this sample. However, a limitation of this study is the use of measurement at only one time-point. It is noted that psychological measures such as level of hope may work better as predictors of future health and immune status, and therefore longitudinal research might reveal more about any relationships that exist between the two (Rabkin, et al., 1990). This study was conducted before the development of Form C MHLOC, a factor that should be kept in mind as a limitation to the measurement of MHLOC in this population at that time.

A recent study with 296 HIV positive patients measured MHLOC at the time of beginning HAART medications and examined relationships with mental and physical

health quality-of-life at a 44-month follow-up (Preau, Vincent, Spire, Reliquet, Fournier, Michelet, et. al, 2005). It was found that high Chance HLOC at baseline measure was associated with lower mental health quality-of-life at follow-up. Additionally, low Chance HLOC and high Internal HLOC beliefs at baseline were associated with greater physical quality-of-life levels at after 44 months (Preau, et al., 2005). Although recent, this study also did not use the condition-specific Form C MHLOC.

Simoni and Ng (2002) addressed the importance of assessing trauma experience and perceptions of control over one's health when providing health services to a large sample of predominantly poor, minority HIV-positive women. This study hypothesized that MHLOC (Form A) would act as a mediator between trauma and perceived health in physically and /or sexually abused HIV positive women. Specifically, a weakened sense of control over an individual's body due to abuse would lead to an external HLOC, increased perceived helplessness, and contribute to maladaptive self-care behaviors and poorer perceived health. Perceived health in this study was a measure of participants' perceptions of how much their HIV and treatment impacted their physical well-being and functioning. In fact, results showed that perceived health was associated independently with both trauma and MHLOC scores for this population. Higher Powerful Others HLOC was associated with worse perceived health and higher Internal HLOC was associated with better perceived health, while Chance HLOC was not a significant predictor of perceived health (Simoni & Ng, 2002). This article suggests that future investigations of the health behavior pathways thru which MHLOC beliefs are related to perceived health would be useful.

MHLOC and Health Behaviors in HIV/AIDS. Health locus of control beliefs have also been examined in HIV/AIDS patient populations in relation to sexual behavior and disease prevention. Two studies examined MHLOC in this context with adolescents, a population in which HIV/AIDS prevention tactics are especially important. A study with African American adolescents found that lower external MHLOC beliefs were one of several psychosocial factors related to higher levels of reported condom use. Girls were found to have greater Internal HLOC beliefs in comparison to the boys in this sample (St. Lawrence, 1993). A small sample of substance-dependent adolescents showed significant change in MHLOC scores after a 5-session HIV risk-reduction intervention that provided risk education, social competency skills, technical skills, and problem-solving training. Specifically, these adolescents showed greater internal and lower external HLOC after the intervention, in addition to increases in HIV/AIDS knowledge, increased self-efficacy, and more favorable attitudes towards prevention and condom use (St. Lawrence, Jefferson, Banks, & Cline, 1994). The results of this study bring into consideration the extent to which MHLOC beliefs are malleable in various populations, including adolescents.

Studies have investigated MHLOC beliefs and condom use in both homosexual and heterosexual adult men. Health locus of control beliefs were examined in relation to sexual behaviors in a large sample ($N = 526$) of men who were patrons of gay bars. It was found that men from this sample who engaged in unprotected anal intercourse had higher Chance and lower Internal HLOC beliefs in comparison to men who did not engage in this risky sexual behavior (Kelly, St. Lawrence, Brasfield, Lemke, Amidei, Roffman, et. al, 1990). In a group of Dutch males who were prostitute clients, those

individuals identified as "consistent condom users" were shown to have weaker external HLOC beliefs than individuals who were "non-consistent condom users" (Vanwesenbeeck, van Zessen, de Graaf & Straver, 1994). A synthesis of these two studies appears to show that higher external and lower internal HLOC beliefs are associated with riskier sexual behavior (i.e. unprotected sex). On the contrary, a study with African American college students showed that MHLOC beliefs did not predict reported frequency of condom use (Burns & Dillon, 2005).

Finally, a study examined several psychosocial factors in attempting to predict initiation and maintenance of safer sexual behavior (defined in this study as abstinence or always using condoms during intercourse) among HIV-negative heterosexual women over time (Morrill, Ickovics, Golubchikov, Beren, & Rodin, 1996). Factors that were associated with the maintenance of safer sexual behavior included MHLOC beliefs, along with depression, and outcome efficacy, while HIV counseling/testing, "partner risk", and optimism were factors helping to explain the initiation of safer sexual behaviors. In particular, maintenance of safer sexual behavior was significantly related to increases in Internal MHLOC scores from baseline to a 3-month follow-up (Morrill, et. al, 1996). Understanding psychosocial factors involved in sexual risk behaviors is important for this population, as heterosexual women are a group known to have increasing rates of HIV infection.

Health Locus of Control and HIV Medications. An especially important area of research regarding HLOC in the context of HIV and AIDS is the relationship with medication acceptance and adherence, key factors in health maintenance for the majority of individuals living with this chronic illness. A study looking at the role of health

beliefs in the acceptance of AZT in HIV positive gay men found no relationship between locus of control and accepting and declining behaviors (Catt, Stygall, & Catalan, 1995). However, the article notes that this outcome agrees with other findings by Wallston and Wallston (1982) in that the poor predictive power of MHLOC may be a result of its strong association with an individual's "value of health" (Catt, et al., 1995). The hypothesis that a combination of high Internal HLOC with a high value of health is predictive of health promoting behaviors was supported in a study on breast cancer (Lau, Hartman, & Ware, 1986). Therefore, a combination of MHLOC and health value beliefs may be relevant in studying healthy behaviors, such as medication acceptance and adherence, for HIV positive populations as well.

In a more recent study with HIV positive gay men ($N = 173$), results showed that participants taking a protease inhibitor (PI) were more likely to have high Powerful Others HLOC beliefs than individuals from this sample who were not taking a PI (Evans, S., Ferrando, S. J., Rabkin, J. G., & Fishman, B., 2000). These results were found while statistically controlling for age, CD4 cell count, HIV viral load, and number of HIV physical symptoms. In particular, the Powerful Others HLOC items relating to doctors and health professionals were significantly endorsed by patients using a PI. This logical correlation pulls into focus the importance of the "doctor-patient" relationship in decisions regarding medication use for HIV positive individuals (Evans, et al., 2000). As this study used MHLOC Form A, it is conceivable that the use of Form C in this sample may have revealed a significant association between anti-HIV medication use and the Doctors subscale, with Other People HLOC beliefs falling out of significance.

Antiretroviral medication adherence was examined in a study with HIV patients in Hong Kong (Molassiotis, Nahas, Chung, Lam, & Lau, 2002). Findings indicated that individuals reporting higher Internal HLOC also reported higher medication adherence. Internal HLOC scores were only one of several factors found to influence medication adherence in this population, suggesting that medication adherence is a multi-dimensional concept (Molassiotis, et al., 2002). A further examination of MHLOC effects on medication usage and adherence is important as HIV medications are rapidly improving and becoming more widely available.

MHLOC and Psychosocial Factors in HIV/AIDS. Support group membership was related to various HLOC scores in HIV positive gay and bisexual British men (Fontaine, McKenna, & Cheskin, 1997). Individuals from this population who were members of HIV support groups were found to have higher scores on Internal and Powerful Others subscales and lower scores on the Chance subscale than individuals who did not belong to support groups. The quasi-experimental design of this study may only indicate that individuals with this HLOC profile are more likely to seek involvement with a support group. However, it is noted that support group membership has been shown as beneficial in managing stressful life events. The HLOC profile of this group may be an indicator of individuals with a more adaptive set of health-related control beliefs. Also, in comparison with healthy populations, it may be more realistic and adaptive for HIV positive individuals to recognize the importance of their doctor's role in health outcomes in addition to their own control (Fontaine, et al. 1997). These findings relate to previously mentioned work by Wallston, Stein and Smith (1994), wherein the idea is

presented that individuals with chronic illness may have high levels of Internal and Powerful Others HLOC simultaneously.

A study involving HIV positive children hypothesized that this population would show higher levels of psychological distress and poorer adjustment in comparison with a demographically matched HIV negative group of children (Bachanas, Kullgren, Schwartz, Lanier, McDaniel, Smith, et al., 2001). The child version of HLOC (developed by Parcel and Meyer, 1978) was administered, and it was predicted that external HLOC would be one of several psychosocial processes accounting for the differences in psychological adjustment for HIV positive and negative children. Surprisingly, results showed no significant differences between the two groups in HLOC scores or for overall indicators of psychological distress and adjustment (Bachanas, et al., 2001). In a longitudinal study with HIV positive homosexual men, higher Chance HLOC scores were predictive of greater psychological distress levels as measured by depressive symptoms, hopelessness, and stress. These results were found while taking into account the severity of illness as measured by CD4 cell counts and HIV viral load, and HIV symptomatology including medical symptoms and history of opportunistic infections (Evans, Ferrando, Rabkin, & Fishman, 1999). In a large sample of HIV positive military medical beneficiaries higher levels of depression were related to a combination of highly endorsed Internal and Powerful Others HLOC beliefs. Overall, results indicated that external HLOC beliefs appeared more adaptive in this sample (Jenkins & Patterson, 1998). Perhaps the MHLOC works differently in relation to psychological distress and depression for various subgroups of the HIV positive population.

Escoto and Flowers (2003) looked at the prevalence of psychopathology in individuals with HIV and AIDS using the *Minnesota Multiphasic Personality Inventory-2*. Results showed several interesting correlations between clinical MMPI scales and health markers: time since HIV diagnosis was related to higher hysteria and social introversion, lower T-cell count (self report) was related to greater depression and hysteria, opportunistic infections were correlated with higher depression and hypochondriasis, and number of medications taken was related to greater hysteria. This article suggests the possibility that HIV-positive individuals show increased psychopathology as a result of seeing changes in these health markers which they interpret as a sign of disease progression. In relation to the MHLOC scales, results indicated that Internal HLOC was negatively correlated with hysteria and depression and positively correlated with mania, and Powerful Others HLOC was significantly related to number of medications taken (Escoto & Flowers, 2003). This study used MHLOC Form A, in which the Doctors HLOC beliefs are subsumed under the Powerful Others HLOC scale. Therefore, it seems possible that beliefs in Doctors HLOC are contributing to the relationship between Powerful Others HLOC and number of medications taken in this sample.

A few studies have begun to explore the role of MHLOC in specific subsets of HIV positive populations, including ethnic minorities. A study by Spalding (1995) comparing the HLOC beliefs of minority and non-minority individuals with HIV and AIDS established that minority individuals were significantly more likely to show higher levels of Powerful Others HLOC. Furthermore, external HLOC beliefs were in most instances associated with more psychological adjustment problems for both groups, and

especially for females and individuals of lower socioeconomic status (Spalding, 1995). The relationship between mental health quality of life (MHQOL) and HLOC was examined in HIV positive Latinos (Burns, Maniss, Young, & Gaubatz, 2005). Internal HLOC was not predictive of MHQOL, but higher Powerful Others HLOC was significantly associated with better self-report mental health ratings for this population. This study noted the importance of understanding how cultural factors may contribute to the formation of HLOC beliefs and the implications of these cultural differences in the treatment of HIV (Burns, et al., 2005). The role of social economic status in MHLOC beliefs was examined in a sample of HIV positive indigent women, and revealed that this group had simultaneous high Internal and external (Powerful Others and Chance) HLOC beliefs (Ragsdale, Koterba, Morrow, & Yarborough, 1995). These indicative results suggest the need for more information about the role of ethnicity and culture in MHLOC beliefs for HIV positive individuals, especially as the rate of infection in minority groups continues to rise in the U.S.

MHLOC and HIV: Dissertation Abstracts. In addition to published journal articles pertaining to HIV and the MHLOC scales, there is a growing body of dissertation abstracts examining this area of research. A review of several of these articles will highlight information not yet brought forth by findings in published peer-reviewed journal articles. One particular study found no significant relationship between MHLOC scores and immune function, as measured by CD4 cell count (Lang, 2001). However, this study used a cross-sectional design, a notable limitation when measuring immune function for HIV positive populations. Interestingly, a study with male HIV-positive military members found that soldiers in later stages of illness had lower levels of Internal

HLOC beliefs when compared to individuals in earlier stages of disease progression (Schempp, 1995).

Several dissertation abstracts looked at MHLOC and various aspects of coping with HIV. In a sample of men and women with HIV-related peripheral neuropathy, Haley (2005) found that higher Chance HLOC scores were positively related to use of maladaptive coping strategies (i.e. praying/hoping and catastrophizing), and higher Internal HLOC beliefs were positively related to use of adaptive active coping strategies (i.e. diverting attention, reinterpreting/ignoring pain sensations). Bluestone (1996) found that higher chance HLOC beliefs were related to greater scores on a measure of "death anxiety" in a group of HIV-positive Caucasian women. Finally, a study with HIV-positive mothers showed that individuals from this sample with a combination of low Internal HLOC and low social support had greater hopelessness, while low Internal HLOC coupled with high social support was related to less hopelessness (Wyatt, 1998). These interesting findings show why the MHLOC scales and HIV is an area of research continuing to draw interest as a topic for examination in dissertation abstracts.

Health Locus of Control and Other Medical Conditions

MHLOC and Medical Outcomes. The MHLOC scales have been used to look at important current issues relating to a number of chronic diseases and medical populations. An examination of findings in this area will shed light on relevant topics that have not been thoroughly studied in HIV/AIDS populations at this time. The meaningful relationship of MHLOC and medical outcomes was suggested in a cross-sectional study with 109 diabetes patients where three MHLOC subscale interactions were significantly related to biological indicators of medical regimen adherence (HbA1c

levels; O'Hea, Grothe, Bodenlos, Boudreaux, White, & Brantley, 2005). Significant moderation effects in this sample included: Internal HLOC beliefs moderated the relationship between Chance HLOC beliefs and HbA1c level, Internal HLOC moderated the relationship between God HLOC and HbA1c level, and Chance HLOC moderated the relationship between Other People HLOC and HbA1c level. Further, participants with the worst HbA1c levels had a combination of high Chance and low Internal HLOC beliefs, while participants with the best adherence rates had a combination of low Other People and low Chance HLOC beliefs (O'Hea, et al, 2005).

A recent study with Japanese hemodialysis patients investigated gender differences in the relationships of Internal HLOC with biological measures of treatment compliance (blood urea nitrogen, serum potassium, and interdialytic weight gain; Takaki & Yano, 2006). Results showed that women in this sample who had higher Internal HLOC beliefs were less compliant to medical treatment regimen. Conversely, for men in this sample, higher Internal HLOC was associated with greater compliance as indicated by the biological markers (Takaki & Yano, 2006). It appears that the relationship between certain MHLOC beliefs and health behaviors are not always clear-cut, and can work quite differently in various populations.

Another important finding with a biological factor as the endpoint measure is in a longitudinal study where lung transplant recipients with medium to high Internal HLOC showed increased survival compared to those with low IHLOC (Burker, Evon, Galanko, & Egan, 2005). The Powerful Others and Chance MHLOC subscales were not found to be related to survival in this study. These results were found while controlling for diagnosis of other medical conditions. This article addresses the need for an investigation

of the pathways through which MHLOC beliefs potentially relate to survival rates in transplant recipient populations (Burker et al, 2005).

MHLOC and Psychosocial Adjustment. The majority of studies looking at chronic illness and MHLOC have found that higher internal locus of control is predictive of advantageous psychosocial adjustment. This conclusion has been made with cancer patients (Sun & Stewart, 2000; Blood, Dineen, Kauffman, & Raimondi, 1993), individuals during end-stage renal disease (Pucheu, Consoli, D'Auzac, Francais, & Issad, 2004), chronic pain patients (Crisson & Keefe, 1988), and individuals with spinal-cord injury (Frank, Umlauf, Wonderlich, Askanazi, 1987). However, some studies have found no association between MHLOC and psychosocial adjustment in cancer (Friedman, Baer, Lewy, & Lane, 1988; de Boer, Ryckman, Pruyn & Van den Borne, 1999), or between MHLOC and psychological distress in cardiac illness (Fowers, 1994). Additionally, some studies have found that higher external HLOC is associated with better adjustment for individuals with cancer (Burish, Carey, Wallston, Stein, Jamison, & Lyles, 2004) and for women with perceived ovarian cancer risk (Franco, Belinson, Casey, Plummer, Tamburrino & Tung, 2000).

In their recent study with early-stage breast cancer survivors Naus, Price and Peter (2005) presented some interesting results in finding that anxiety moderated the relationship between condition-specific MHLOC (i.e. Form C) and depression. Higher rates of depression were found in individuals with high levels of anxiety who did not endorse Internal HLOC beliefs, while lower rates of depression were found with the combination of low anxiety and Internal HLOC beliefs. Conversely, Internal HLOC predicted higher levels of depression in individuals with high anxiety, indicating that

these beliefs may be maladaptive in some populations. Additionally, individuals endorsing a Doctors HLOC showed lower levels of depression when less anxious, and higher levels of depression when more anxious. At low levels of anxiety, Other People HLOC beliefs were associated with depression, but depression levels were high when coupled with higher anxiety levels regardless of Other People HLOC. Finally, it was found in this study that anxiety did not moderate the relationship between Chance HLOC and depression for breast cancer survivors (Naus, Price and Peter, 2005). This study highlights the need for additional research to understand the complex relationships between MHLOC beliefs and other psychosocial factors in medical populations.

In a cross-sectional study of end-stage renal disease patients, researchers found that the relationship between Internal HLOC and depression was moderated by whether or not the patient had experienced a failed transplant. Specifically, for patients experiencing a failed transplant, higher Internal HLOC was associated with greater depression levels, while higher Internal HLOC was associated with lower depression levels in group who had never received a wanted transplant (Christensen, Turner, Smith, Holman & Gregory, 1991). A study that investigated depression in chronic kidney disease patients brings forth evidence that changes in Internal HLOC over time may become an important factor in determining adjustment with chronic illness progression. Results from this study showed that patients in this sample whose Internal HLOC scores increased at one-year follow-up reported lower levels of depression during the time since baseline measurement (Cvengros, Christensen, & Lawton, 2005). A review of the literature clearly shows that the MHLOC tools are useful in understanding important factors involved in numerous medical populations today.

Psychosocial Factors and HIV/AIDS: Exploration of Possible Mediators

Throughout the HIV/AIDS epidemic, researchers have been studying the impact of psychosocial factors on HIV disease progression. While there are some mixed findings, there is a growing body of evidence that numerous psychosocial variables are significantly related to HIV disease progression, both before and after the advent of HAART. Noteworthy variables that have been studied in this realm include depression, coping, stressful life events, social support, optimism, and hopelessness. Specific findings for each variable will provide an overview of this topic.

Numerous studies have shown that depressive symptoms are related to HIV disease progression. Depressive affect was found to be associated with mortality risk (adjusted risk ratio of 1.67) in a sample of 402 HIV positive gay and bisexual males followed longitudinally (Mayne, Vittinghoff, Chesney, Barrett & Coates, 1996). In another study, depressive symptoms were found to predict shorter longevity, but were not associated with progression to AIDS or change in CD4 cell count in a sample of HIV positive males (Patterson, Shaw, Semple, Cherner, McCutchan, Atkinson, et. al, 1996). In a study with HIV positive women, it was concluded that depressive symptoms were associated with HIV disease progression while controlling for clinical, substance use, and socio-demographic factors (Ickovics, Hamburger, Vlahov, Schoenbaum, Schuman, Boland, et al, 2001). Cumulative depressive symptoms were associated with an increased risk of progression to AIDS at follow-up in HIV positive gay men who were asymptomatic at baseline (Leserman, Jackson, Petitto, Golden, Silva, Perkins, et al, 1999; Leserman, Petitto, Gu, Gaynes, Barroso, Golden, Perkins, et al, 2002). Even during the era of HAART medications, depression was found to significantly predict changes over

time in CD4 count and HIV viral load in a sample of HIV positive men and women, while controlling for medical and demographic factors (Ironson, O'Cleirigh, Fletcher, Laurneceau, Balbin, Klimas, et al, 2005).

The interplay between depression and other psychosocial factors has also been shown to relate to HIV disease progression. The interaction of depressive symptoms with life adversity predicted decline in percentage of CD4 lymphocytes in a sample of HIV positive men (Patterson, Semple, Temoshok, Atkinson, McCutchan, Straits-Troster, et al, 1995)

Different styles of coping have been linked to HIV disease progression in numerous research studies. Coping by means of denial predicted faster decline in CD4 cells, faster progression to AIDS, and increased mortality in a longitudinal study with HIV positive gay men (Ironson, Friedman, Klimas, Antoni, Fletcher, LaPerriere, et al, 1994). Another longitudinal study with gay men also found that coping through denial was significantly associated with faster progression to AIDS (Leserman, Petitto, Golden, Gaynes, Gu, Perkins, et al, 2000). Additionally, active coping was found to predict decreased clinical progression (Mulder, Antoni, Dulvenvoorden, Kauffmann, Goodkin, 1995) and slower progression to AIDS (Vassend, Eskild & Halvorsen, 1997). Since HAART has become available, one study with HIV-positive men and women found an association between avoidant coping and faster disease progression, as measured by changes in viral load and CD4 cell count over two years (Ironson, O'Cleirigh, et al, 2005). In this study, avoidant coping was a combination of denial and behavioral disengagement subscales. In conclusion, these findings indicate that different coping styles may have beneficial or detrimental effects on the progression of HIV.

The investigation of stressful life events as a predictor of HIV disease progression has produced mixed results. Stressful life events have been found to predict risk of progression to AIDS (Leserman et al, 2000; Leserman, et al, 2002), faster decline in CD4 cells (Patterson, et al, 1995), and increased risk of HIV disease stage progression (Evans, Leserman, Perkins, Stern, Murphy & Zheng, 1997) in gay men. However, another study found that stressful life events were not associated with advance in symptoms, CD4 cell count, AIDS, or mortality (Patterson et al, 1996). Other studies have also not found an association between stress and a decrease in CD4 cell count (Perry, Fishman, Jacobsberg, & Frances 1992; Rabkin, Williams, Remien, Goetz, Dertzner, & Gorman, 1991). It is noted that many of the studies showing no relationship between stress and HIV progression were conducted over relatively short follow-up periods and used self-report questionnaires. On average, evidence points to the fact that stress does play a role in HIV disease progression.

Social support is another psychosocial variable that has led to mixed results when examined as a predictor of HIV progression. A longitudinal study with gay men found that higher levels of social support predicted slower progression to AIDS (Leserman et al, 1999) and longer survival (Leserman et al, 2002). One study found that large social network sizes predicted longevity, but only for individuals with AIDS-defining symptoms at baseline, possibly implying that disease outcome is affected by social support during later stages of HIV progression (Patterson, et. al, 1996). Two studies, one before and one since the advent of HAART, found no association between social support and HIV disease progression. At 6 and 12-month follow-up, a sample of HIV positive adults showed no association between CD4 cell count (as a disease progression marker)

and social support, prior to HAART (Perry, et. al, 1992). Additionally, social support was not significantly related to changes in CD4 cell count or HIV viral load at a 2-year follow-up in a sample of individuals during the era of HAART (Ironson et al, 2005). Further, another study found that faster CD4 cell count decline was predicted by higher social support in HIV positive gay and bisexual men (Miller, Kemeny, Taylor, Cole, & Visscher, 1997). The conflicting results in this area highlight the need for more research on psychosocial factors and HIV disease progression, as many of these relationships are not well understood.

A number of different beliefs, including optimism/pessimism, hopelessness, and self-efficacy have also been examined in HIV disease progression. Researchers found that greater levels of dispositional optimism and lower levels of hopelessness predicted slower HIV disease progression, as measured by changes in CD4 cell count and viral load, over the course of two years (Ironson, Balbin, Stuetzle, Fletcher, O'Cleirigh, Laurenceau, et al, 2005). These findings were in a diverse sample of 177 HIV-positive individuals, and while controlling for baseline CD4 and viral load, antiretroviral treatment, race, gender, education, and drug use (Ironson & Balbin, et al, 2005). Another study looking at optimism and HIV disease progression showed that dispositional optimism had a curvilinear relationship with follow-up measures of CD4 count. In addition, results indicated that greater levels of pessimism predicted higher levels of viral load at follow-up in this sample (Milam, Richardson, Marks, Kemper & McCutchan, 2004).

While Ironson and O'Cleirigh, et al (2005) is the only study to date that has shown an association between hopelessness and HIV disease progression, there is some

existent research looking at other aspects of hopelessness in HIV positive individuals. One study looked at a large, diverse sample of HIV-positive individuals experiencing the loss of a loved-one to HIV/AIDS. Results indicated that baseline measures of active coping were positively associated with baseline measures of optimism and negatively associated with baseline hopelessness, while the opposite pattern was found for avoidant coping (Rogers, Hansen, Levy, Tate, Sikkema, 2005).

Finally, a study looked at changes in viral load and CD4 cell count at a three-month follow-up in a group of HIV-positive women after a cognitive behavioral intervention (Ironson, Weiss, Lydston, Ishii, Asthana, & Tobin, et al, 2005). For women in the intervention group, increases in AIDS self-efficacy were related to increases in CD4 cell count and decreases in viral load. Additionally, increases in cognitive-behavioral skills self-efficacy were related to decreased distress and decreased viral load. These results were found only in the intervention group, and were not found in a control group of HIV-positive women who were not involved in the cognitive behavioral intervention. Overall, some studies have brought meaningful insight into the relationships between various beliefs and disease progression in HIV-positive populations, but further research is needed in this area. The health locus of control scales are a measurement of particular beliefs that have not yet been examined in relation to HIV disease progression.

Investigation of Healthy HIV-Positive Individuals with Low CD4 Counts

Individuals with HIV experience a great deal of variation from each other in the course that their disease progression follows. As a result, researchers have become interested in studying the characteristics of HIV-positive individuals with particularly

unique paths of disease progression. One such group is comprised of individuals who experienced a period of at least nine months when they had very low CD4 cell counts (below 50), were not using protease inhibitors, and yet remained asymptomatic. The fact that these individuals were healthy with such low CD4 cells is intriguing, as the typical course of HIV progression involves the expectation that the onset of AIDS-defining symptoms will begin after CD4 cells drop below a count of 200.

A small group of individuals meeting the healthy low CD4 (HLC group; n = 30) criteria thus described was compared to a group of HIV-positive individuals in the midrange of progression (Comparison group; CD4 counts between 150-400 and never had AIDS-defining symptoms), and to a group of HIV-negative controls (Ironson, Balbin, Solomen, Fahey, Klimas, Schneiderman, Fletcher, 2001). Results of this study indicated that the HLC group had significantly higher levels of natural killer cell cytotoxicity (NKCC) and natural killer cell number (NK#) than the HIV-positive Comparison group. It is noted that the differences between these two groups were not due to differences in potential confounding variables including: use of protease inhibitors, ethnicity, income, sleep, stressful life events, and drug/alcohol use. Additionally, the HLC group was not significantly different from the HIV-negative group on NKCC and NK#. These results provide evidence that NKCC may be a protective factor for this rare group of healthy individuals with low CD4 cells. These researchers suggest future analyses looking at potential differences between the HLC and HIV-positive Comparison groups on various psychological variables (Ironson et. al, 2001).

In this same sample, a currently unpublished article examined emotional disclosure and emotional/cognitive processing through writing about a traumatic

experience in relation to healthy low CD4 (HLC) status (O'Cleirigh, Ironson, Antoni, Fletcher, McGuffey, Balbin, Schneiderman, under review). This study found that the HLC group had higher levels of emotional disclosure and emotional/cognitive processing than an HIV-positive comparison group, and that the relationship between emotional disclosure and healthy survival was mediated by emotional/cognitive processing. Disclosure of HIV status and NK cell number were found to further mediate the relationship between emotional/cognitive processing and protected health status .

In summary, investigations with this unique group of HIV-positive individuals known as the healthy low CD4 (HLC) group have provided insight on how this population differs from groups of HIV-positive individuals experiencing a more normal course of disease progression. Results have indicated that this group differs from a control group in both biological (NK# and NKCC) and psychological (emotional disclosure and emotional/cognitive processing) factors. Further inspection with other psychosocial factors will help to paint a clearer picture of the psychological profile of these individuals with protected health status.

Summary and Conclusions

The Multidimensional Health Locus of Control scales are well validated and reliable measures of beliefs about the source of control over one's health status, and have evidenced utility in research with numerous medical populations. Intriguing results have been found when measuring this construct in HIV/AIDS populations in relation to numerous other psychosocial variables, including: hope, quality of life, social support, psychological distress, depression, perceived health, psychological adjustment, health value beliefs, and doctor-patient relationship. Additionally, a few studies have shown

that various MHLOC beliefs were related to health behaviors, such as HIV medication acceptance and adherence, and risky sexual behaviors. In other chronic illness populations, there have been some studies looking at MHLOC in relation to biological markers of health adherence, and one study relating this construct to length of survival. Overwhelmingly, there is a paucity of research examining potential relationships between MHLOC beliefs and markers of disease progression and survival.

Objectives

The purpose of the present study is to examine health locus of control beliefs in a rare group of HIV positive individuals who experienced an asymptomatic period with very low CD4 cells, without the aid of protease inhibitors. This unique group with healthy low CD4 (HLC) status will be compared (on the Multidimensional Health Locus of Control scales (MHLOC)) with a matched control (MC) group of HIV positive individuals in the midrange of disease progression. An examination of several factors working as potential mediators will provide a richer understanding of the interconnections between health locus of control beliefs and HIV group membership (HLC vs. MC).

Aims, Hypotheses, and Proposed Analyses

The overall hypothesis being tested is that there is a relationship between healthy low CD4 status and health locus of control beliefs. Specifically, it is hypothesized that individuals with healthy low CD4 status (HLC group) will differ from individuals in the midrange of HIV disease progression (MC group) on particular beliefs about the locus of control over their health (stated below) even while controlling for several demographic variables. A number of psychosocial factors are hypothesized to work as mediators and moderators involved in the relationships between health locus of control and HIV group membership (HLC vs. MC). Figure 1 displays a hypothetical model of the relationship between health locus of control beliefs and protected health status (HLC group membership) in HIV.

Aim 1. To determine whether two groups (HLC and MC) of HIV positive individuals differ on the four MHLOC subscales (Internal, Chance, Other People, and Doctors).

Analysis for Aim 1. A Hotelling's T^2 omnibus test will be performed to assess the significance of difference between the HLC and MC groups on all four of the MHLOC subscale scores.

Hypothesis 1. The healthy low CD4 (HLC) group will be significantly different from the matched control (MC) group on Internal MHLOC subscale scores. There is evidence in the literature to support the hypothesis that the HLC group will be higher than the MC group on the Internal subscale. However, there is also literature to support the opposite hypothesis, that the HLC group will have lower Internal beliefs than the MC group. Therefore, it is hypothesized that the HLC group will be either higher or lower on the Internal subscale in comparison to the MC group.

Hypothesis 2. The HLC group will be significantly higher on the Doctors MHLOC subscale in comparison to the MC group.

Hypothesis 3. The HLC group will be significantly lower on the Chance MHLOC subscale in comparison to the MC group.

Hypothesis 4. The HLC group will be significantly lower on the Other People MHLOC subscale in comparison to the MC group.

Analyses for Hypotheses 1-4. After conducting the Hotelling's T^2 omnibus test, independent samples t-tests will be performed to assess the significance of difference between the HLC and MC groups on each of the four MHLOC subscales: Internal, Chance, Other People, and Doctors.

Aim 2. The MHLOC "profile" will be examined for both groups of HIV positive individuals (HLC and MC) separately. It will be determined whether scores on some MHLOC subscales are higher than scores on the other subscales within each group. This will provide information about the degree to which each group has Internal, Chance, Other People, and Doctors HLOC beliefs, irrespective of comparisons between the two groups.

Hypothesis 5. The HLC group will have significantly higher scores on the Internal and Doctors MHLOC subscales in comparison to their scores on the Chance and Other People MHLOC subscales.

Hypothesis 6. The control group will have significantly higher scores on the Chance and Other People subscales in comparison to their scores on the Internal and Doctors MHLOC subscales.

Analyses for Hypotheses 5 & 6. First, subscale scores will be converted to average item scores for each of the four subscales. Next, Repeated Measures Analysis of Variance (ANOVA) will be performed to assess for significance of difference between the Internal, Doctors, Chance and Other People subscales for each group (HLC and MC) separately. Post hoc analysis will determine if Internal and Doctors scores are significantly higher than Chance and Other People scores for the HLC group, as hypothesized. Post hoc analysis will also be used to determine if Chance and Other People scores are significantly higher than Internal and Doctors scores for the MC group, as hypothesized.

Aim 3. To determine whether particular MHLOC subscale scores moderate the relationship between other MHLOC subscale scores and group membership.

Hypothesis 7. Interactions between particular pairs of the MHLOC subscales will reveal moderation effects. It is predicted that Internal scores will moderate the relationship between Chance scores and group membership (HLC vs. MC). Specifically, HLC group membership will be associated with a combination of high Chance scores and high Internal scores, while MC group membership will be associated with high Chance scores and low Internal scores. Additionally, it is hypothesized that Doctors subscale scores will moderate the relationship between Internal scores and group membership. HLC group membership will be associated with a combination of low Internal and high Doctors scores, and MC group membership will be associated with low Internal and low Doctors scores.

Analysis 7. First, scores on the Internal, Chance and Doctors MHLOC subscales will be centered. Then, the centered Internal scores will be multiplied by centered Chance scores, and centered Chance scores will be multiplied by centered Doctors scores, in order to form two interaction terms to test the moderation hypotheses. The hypothesis that Internal scores moderate the relationship between Chance scores and group membership will be tested with the regression equation:

$$\textit{Group Status} = \textit{Internal} + \textit{Chance} + \textit{Internal x Chance} + \textit{error.}$$

The hypothesis that Doctors scores will moderate the relationship between Internal scores and group membership will be tested with the regression equation:

$$\textit{Group Status} = \textit{Doctors} + \textit{Internal} + \textit{Doctors x Internal} + \textit{error.}$$

Aim 4. To determine whether several psychosocial factors work as mediators of the relationship between certain MHLOC subscale scores and group membership.

Hypothesis 8. The following variables will be considered as potential mediators in the relationship between the MHLOC subscales and group membership: depression, coping, social support, hopelessness, optimism, self efficacy, and perceived stress. It is hypothesized that depression, coping, hopelessness, optimism, perceived stress and self-efficacy will all mediate the relationship between the Internal MHLOC subscale and group membership. Hopelessness and optimism are hypothesized to mediate between the Chance subscale and group membership, while social support and coping are hypothesized to mediate between the Other People subscale and group membership.

Analysis 8. A series of three multiple regression analyses according to Baron and Kenny (1986) will be used to determine whether the hypothesized variables act as mediators in the relationship between MHLOC and group membership. In the first equation, group membership (outcome variable) will be regressed onto the MHLOC scales (independent variable). Next, the mediator variable will be regressed onto the MHLOC scales. In the last equation of the series, group membership will be regressed on both the MHLOC scales and the mediator variable. Mediation is suggested when the independent variable (MHLOC) is a significant predictor in the first two equations, but only the mediator is a significant predictor in the third equation.

The specific analyses for depression as a mediator of the relationship between Internal HLOC and group membership will provide an example of these steps. Initially, group membership will be regressed on Internal HLOC with the equation:

$$Group\ Membership = Internal\ HLOC + error$$

Then depression will be regressed on Internal HLOC with the equation:

$$Depression = Internal\ HLOC + error$$

Finally, group membership will be regressed on both Internal HLOC and depression with the equation:

$$Group\ Membership = Internal\ HLOC + Depression + error$$

As a final step, the Sobel test will be used to test for the significance of mediation (Sobel, 1982).

Validity Check. In order to verify the measurement methods used when assessing MHLOC in this study, a validity check will be conducted. When the MHLOC questionnaire (Form C) was administered to study participants, the term "condition" in the measure was not specified as meaning HIV. It is hypothesized that the majority of participants in this study interpreted the term "condition" to mean HIV without verbal instruction. With the intention of testing this hypothesis, the MHLOC Form C will be administered to a sample of 30 HIV-positive research participants involved in a current study conducted by the same research team. After completing the questionnaire, participants will be asked to describe their interpretation of the term "condition". Responses to this question will be categorized into three levels representing the interpretation of "condition": 1 = HIV only, 2 = HIV and other meanings, 3 = other meanings/not HIV. The frequency of each response in the sample will be examined as a measure of many participants were interpreting the term “condition” as meaning HIV when answering each item of the MHLOC.

Method

Participants

Two groups of HIV-seropositive individuals were recruited during 1997 to 1999 as paid volunteers for this study. Recruitment was conducted at sites including physician offices, specialty clinics, service organizations, and hospitals in South Florida for the University of Miami, and in the Los Angeles area for the University of California, Los Angeles. The first group of participants, Healthy Low CD4 patients (HLC; n = 70) had experienced a period of at least nine months during which they had less than 50 CD4 cells/mm3 and were asymptomatic (as confirmed by doctor records) while not using protease inhibitor medications. Of the full HLC sample (n = 70), 32 participants were recruited in Los Angeles and 38 participants were recruited in Miami.

The second group was an HIV-seropositive matched control group (MC; n = 70), who were in the mid-range of HIV disease progression, with CD4 cell counts between 150 and 500 cells/mm3 at time of study entry. Additionally, the control group had no history of CD4 cell counts below 75/mm3, and had never experienced any AIDS defining Category C symptoms (e.g., Kaposi's sarcoma, pneumocystis carinii pneumonia, toxoplasmosis, etc.). All participants comprising the control group were recruited in Miami. This group of HIV-positive individuals was chosen as a control group for the HLC group based on the assumptions that their disease progression was following a more typical course, and that the great majority of this group would not reach the requirements of HLC status.

The MC group was systematically chosen from a larger control group (n = 177), in order for the MC group to be exactly matched to the HLC group on several

demographic variables. Initial analyses revealed that the HLC group and larger control group differed significantly on employment ($\chi^2 = 34.904$; $p = .000$; HLC > MC on disability). The two groups were not significantly different initially ($p > .05$) on gender, ethnicity, education, income, sexual orientation, route of infection, age, average number of hours of sleep in past week, average number of hours of exercise in the past week, total number of sexually transmitted diseases in past, and number of stressful life events in past six months. Information regarding antiretroviral medication adherence and past drug/alcohol abuse and dependence was not collected for the UCLA sample; therefore, groups were not compared on these factors due to missing data. Next, a detailed description of the matching procedures used will be provided.

Matching procedures. Seventy HLC participants were systematically matched one-to-one with seventy participants from the larger control group ($N = 177$). Participants from both groups were matched based on order of entry into the study and following matching procedures for demographic variables, as will be outlined next. Originally, an attempt was made to match the seventy HLC participants with seventy control participants on the following demographic variables, in this order: gender, education, ethnicity, and employment. No attempt was made to match on HIV disease progression markers (CD4 cell count, HIV viral load, antiretroviral medication use), as this information was inherently different for the two groups based on group definition. The education variable was reduced to four categories (some high school and < 8th grade education, high school graduate, trade school or some college, and college graduate or graduate degree). Ethnicity was also reduced to four categories (African American, Caucasian, Hispanic, and "others"). The "others" category consists of participants who

identified their ethnicity as American Indian, Asian American, Haitian, biracial or other. Employment was reduced to four categories as well (disability, part-time, full-time, and other). The "other" category consists of participants who identified their employment as student, unemployed, or other. Exact matching on these four variables resulted in twenty HLC participants who did not match with a control group participant. Noted patterns that prevented matching included the fact that almost all of the HLC participants in the "others" category were unmatchable with a control group participant, as well as the fact that there was great difficulty matching participants on employment.

As it was difficult to match on employment and ethnicity, a second attempt was made to match each HLC participant with a control participant. For this second round of matching, income replaced employment as a variable indicating participants' social economic status. Therefore, participants were matched on the following variables, in this order: gender, education (4 categories) ethnicity (4 categories), and income (2 categories). Income was reduced to two categories: less than $20,000 per year income, and more than $20,000 per year income. A system was created to ensure that participants in the "others" ethnicity category were not excluded from the matched groups. When an HLC participant in the African American, Caucasian, or Hispanic ethnicity category did not match up with a control participant on ethnicity, they were matched with a control participant in the "others" ethnicity category who matched exactly with their gender, education, and employment. Consequently, four control participants in the "others" ethnicity category were used as matches with an HLC participant. Only one participant from the HLC group in the "others" ethnicity category was able to match with a control participant exactly on all four variables. The six remaining HLC "others" ethnicity

participants were matched with control participants of other ethnicities who were exact matches on gender, education, and income. In order to maintain the ethnicity frequency represented in the full HLC group, the six "others" ethnicity HLC participants were matched with 3 Caucasian, 2 African American, and 1 Hispanic control participants. This was done after all Caucasian, Hispanic, and African American HLC participants were already matched with control participants.

After following the procedures described thus far, three HLC participants were still unmatchable with a control participant on education. Therefore, these three HLC participants were matched with control participants who were exact matches on gender, ethnicity, and income, while the education category was matched one category up or down. Specifically, one HLC participant in the "High School Graduate" category was matched with a control participant in the "some High School and < 8th grade" education category. Another HLC participant in the "trade school or some college" education category was matched with a control participant in the "college graduate or graduate degree" category. Finally, one HLC participant in the "trade school or some college" education category was matched with a control participant in the "college graduate or graduate degree" category. At this point, all seventy HLC group participants were matched one-to-one with a participant from the larger control group on gender, education, ethnicity, and income. The seventy selected control group participants comprise the matched control (MC) group used in analyses.

Exclusion Criteria. Subjects were excluded if they had current drug or alcohol abuse or dependence, had used intravenous street drugs within 9 months prior to recruitment, or had another potentially life-threatening illness (e.g., cancer).

Additionally, individuals were excluded from participation if they endorsed current psychotic or suicidal symptomology, or had dementia. Participants were required to be at least 18 years of age. Initial participation was delayed for 3 months for individuals who had recently been bereaved, undergone surgery, or made significant changes to their anti-HIV medication regimens.

Collection Procedures

At the first time point, an interviewer described the nature of the study and explained confidentiality issues to all participants. Participants were asked to sign informed consent forms, completed a battery of psychosocial questionnaires, and underwent a blood draw and brief physical exam. For all participants, blood draws occurred between 9:00 and 11:00 a.m., to control for potential diurnal variation. Finally, participants met with a study interviewer to complete a clinical assessment interview.

Measures

Control variables. At study entry, participants completed self-report questionnaires assessing demographic (gender, age, ethnicity, education, employment, income and sexual orientation) and medical information (average # of hours of sleep in past week, number of sexually transmitted diseases in past, antiretroviral medication use, and route of HIV infection) information. The route of infection variable was compiled from subject responses to the question "How do you believe you got HIV?" The levels of this variable include: heterosexual sex, gay/bisexual sex, multiple routes (including intravenous drug use) and "other". Stressful life events were also measured as a potential control variable, using the Life Experiences Survey (Sarason, Johnson & Siegel, 1978).

Participants endorsed whether or not they had experienced various life events in the past six months and the total number of stressful life events was the measure used.

Multidimensional Health Locus of Control. The measure used in this study to assess health locus of control beliefs was Form C of Wallston's Multidimensional Health Locus of Control scales (see Appendix A; Wallston, Stein & Smith, 1994). Form C MHLOC is a *condition-specific* locus of control scale consisting of four subscales: Internal, Chance, Other People, and Doctors. The term "condition" is used in each item to refer specifically to control beliefs about the participant's medical condition (in this case HIV), versus beliefs about the control of one's general health. The Internal and Chance subscales have six items each, while the Other People and Doctors subscales have three items each. The Internal subscale measures the degree to which one believes that their behaviors control their health status (e.g., "If my condition worsens, it is my own behavior which determines how soon I will feel better again"). The Chance subscales measures the degree to which one believes their health status is controlled by fate, chance or luck (e.g., "As to my condition, what will be will be"). The Other People subscales measures the degree to which an individual believes their health status is controlled by other people, such as family and friends (e.g., "In order for my condition to improve, it is up to other people to see that the right thing happens"). Finally, the Doctors subscales measures the degree to which an individual believes that health care professionals, such as doctors and nurses, control their health status (e.g., "If I see my doctor regularly, I am less likely to have problems with my condition"). Participants are asked to rate, using a six-point Likert (1 to 6) scale, the degree to which they agree or disagree with each statement. Subscale scores can range from 6 to 36 on the six item

subscales, and from 3 to 18 on the three item subscales, with higher scores indicating a greater degree of belief in the MHLOC dimension being assessed.

Wallston, Stein and Smith (1994) determined Cronbach's alpha values equal to or greater than .70 for each of the four Form C MHLOC subscales as measured in two separate large samples comprised of participants with various chronic medical conditions, showing acceptable internal consistency for these scales. Specifically, for the Internal scale r = .87 and .85 (sample 1 and sample 2), for the Chance scale r = .82 and .79, for the Doctors scale r = .71 and .71, and for the Other People scale r = .71 and .70. Stability coefficients were moderate to high when tested with samples over short periods, and test-retest reliability is adequate. Correlation of the subscales from Form C with Form B MHLOC evidenced concurrent validity (Wallston et al., 1994). As reviewed in the Introduction, the MHLOC scales have been significantly related to health behaviors and health outcomes in numerous populations.

Social support. It is hypothesized that social support will mediate the relationship between the Other People MHLOC subscale and group membership (HLC vs. MC). The ENRICHED Social Support Instrument (ESSI) was used to measure social support. The ESSI is a seven-item scale assessing support over a one month period, including an item asking is participants are married/partnered or not (Mitchell, Powell, Blumenthal, Norten, Ironson, Pitula, Froelicher, Czajkowski, Youngblook, Huber & Berkman, 2003).

Coping. Coping was included in this study because different coping styles are hypothesized to mediate the relationship between Internal and Other People MHLOC subscale scores and group membership. The endorsement of twelve different cognitive and behavioral coping strategies was assessed using the COPE, a 24-item scales modified

for use with HIV populations (Carver, Scheier & Weintraub, 1989). The denial and behavioral disengagement subscales of the COPE were combined to create an avoidant coping composite, while 5 subscales (planning, positive reframing, active coping, acceptance, and emotional support) were combined via factor analysis to construct an adaptive coping construct.

Perceived Stress. Perceived stress is a hypothesized mediator in the relationship between Internal MHLOC and group membership, and was measured by the ten-item version of the Perceived Stress Scale (PSS; Cohen & Williamson, 1988) which assesses the "degree to which situations in one's life are appraised as stressful".

Optimism. Optimism is hypothesized as a mediator between Internal and Chance MHLOC beliefs and group membership, and was measured by a composite of the Life Orientation Test (LOT; Scheier & Carver, 1985), and the LOT-R (Scheier, Carver & Bridges, 1994), a measure of dispositional optimism. The measure consists of a four point scale (1 to 4) asking to what degree the participant agrees with nine different statements; higher optimism is represented by higher scores.

Depression. Depression is included in this study because it is hypothesized to be a mediator in the relationship between Internal MHLOC beliefs and group membership. The Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, Erbaugh, 1961) was used as a measure of cognitive, affective, and behavioral symptoms of depression over the past week. The BDI is a 21-item scale and has subscales measuring affective (items #1-13) and somatic (items #14-21) depression subscale symptoms (Beck, Ward, Mendelson, Mock, Erbaugh, 1961).

Hopelessness. Hopelessness will be examined as a hypothesized mediator of the relationship between both Internal and Chance MHLOC subscales and group membership. A 20-item true/false questionnaire known as the Beck Hopelessness Scale (BHS) was used to examine feelings about the future, loss of motivation, and expectations (Beck, Weissman & Trexler, 1974).

Self Efficacy. It is hypothesized that self-efficacy will mediate the relationship between Internal MHLOC and group membership. The questionnaire used to measure self-efficacy in this study is an iteration of the Self-Efficacy Inventory form developed by Ironson and Weiss, et al (2005). The self-efficacy questionnaire uses an 11 point scale (0 to 10) for 11 items asking to what degree the participant feels confident to do certain behaviors when things are not going well for them; higher self-efficacy is represented by higher scores. A factor analysis was conducted for this measure, using varimax rotation, eigenvalues over 1.00, and excluding cases pair-wise for missing data. Results indicated factors representing two separate subscales, and one independent item (#11). Subscale 1, labeled as "self-efficacy for lifting negative mood" (e.g. "calm yourself down when you are feeling irritated or frustrated"), consists of items #3, 4, 5, 9 and 10. Subscale 2 is labeled as "action-oriented self-efficacy" (e.g. "get your doctor to help give you treatment you need"), and consists of items #1, 2, 6, 7 and 8. Item #11 represents AIDS self-efficacy (i.e. "how confident are you that you can retard the development of symptoms of AIDS and prolong your life"). Reliability analyses indicate $\alpha = .90$ for Subscale 1, and $\alpha = .80$ for Subscale 2.

Immunological measures. The methods for the CD4 cell and viral load assays are the same as those in a journal article published from the same research lab (O'Cleirigh, Ironson, Antoni, Fletcher, McGuffey, Balbin, et al, 2003), and are as follows:

CD4 cell number. Flow cytometry was used to enumerate CD3 + CD4+ lymphocytes. This analysis was conducted by staining whole blood samples with saturating concentrations of flurochrome conjugated monoclonal antibodies in a four-color system. The erythrocytes were lysed and the samples fixed overnight with Optilyse C reagent (Immunotech, France). The samples were washed in phosphate buffered saline, pH 7.4, and analyzed on a coulter XL-MCM flow cytometer. A Coulter MaxM electronic hematology analyzer was used to calculate the total lymphocyte count so that the percentage of total lymphocytes generated by the flow cytometer could be converted to an absolute count for each subset (CDC, 1997).

HIV-1 viral load. Viral load for HIV-1 was completed using the Roche Amplicor RT/PCR assay which is sensitive down to 400 copies of HIV RNA in plasma.

Results

The purpose of this study was to investigate health locus of control beliefs in two HIV positive samples. A unique group of individuals, who were asymptomatic despite low CD4 cell counts and without taking HAART, were the main focus of this study and are labeled the healthy low CD4 group (HLC group). The HLC group was compared to a group of individuals in the mid-range of HIV disease progression (Matched Control (MC) group) on health locus of control beliefs. The two groups were systematically matched on several control variables. Dimensions of health locus of control beliefs for each group were also examined within each group. Finally, this study investigates several variables as moderators and mediators in the relationship between health locus of control beliefs and group status (HLC group vs. MC group).

Health locus of control beliefs were measured with Form C of the Multidimensional Health Locus of Control scales (MHLOC; Wallston, Wallston, & DeVellis, 1978). Form C is a condition-specific version of the original MHLOC measure, with a Doctors subscale in addition to the three original subscales (internal, chance, other people). Therefore, this version was chosen for the current study as it is a more appropriate measure of health locus of control beliefs for medical populations.

Participant Characteristics

Seventy participants meeting the inclusion and exclusion criteria for the HLC group were recruited, including 32 at the Los Angeles site and 38 at the South Florida site. As previously described in detail (see Methods section), the 70 HLC participants were matched on key demographic variables (gender, ethnicity, education, income) with 70 participants from a larger sample ($N = 177$) who met eligibility requirements of being

in the mid-range of HIV disease progression. These 70 participants comprise the matched control (MC) group, and were all recruited at the South Florida site.

Initially, employment was selected as a demographic variable included in the matching process. However, matching on this variable was not possible, due to the fact that the majority of participants in the HLC group (84.3%) were on disability while only 42.9% of the larger control group (from which the matched control group was selected) reported a disability employment status. In an attempt to make the two groups (HLC and MC) equivalent on the employment variable, all participants on disability from the larger control group ($N = 177$) were included in the MC group after participants in the other employment categories were matched. This resulted in 116 participants in the MC group matched with 70 participants in the HLC group. However, chi-square analysis revealed that the two groups were still significantly different on this variable (χ^2 (3, $N = 186$) = 8.537, $p = .036$). Therefore, it was concluded that the two groups could not be matched on employment, and income replaced employment as a variable representing socioeconomic status in the matching procedures (as described above). Furthermore, the disparity between the two groups in the percentage of participants on disability was likely confounded by the fact that participants in the HLC group (by group definition) had lower CD4 cells. It is common practice that HIV-positive individuals with very low CD4 cells are put on disability by their physicians, as their health problems are likely to result in difficulty maintaining employment.

Demographics for the two groups are presented in Tables 1 and 2. Participants in the HLC group included 54 men and 16 women who ranged in age from 24 to 54 with a mean age of 38.26 years. Five participants in this group had less than an 8th grade

education or some high school, 10 participants were high school graduates, 34 were graduates of trade school or had some college, and 21 were college graduates or had a graduate degree. The group was ethnically diverse with 29 Caucasian, 20 African American, and 14 Hispanic participants, and 7 participants in the "others" ethnicity category. The majority of the sample (n = 59) had an income of less than $20,000 per year while 11 participants in this group had an income of more than $20,000 per year.

Participants in the MC group included 54 men and 16 women who ranged in age from 20 to 59 with a mean age of 37.83 years. Six participants in this group had less than 8th grade education or some high school, 9 were high school graduates, 32 were graduates of trade school or had some college, and 23 were college graduates or had a graduate degree. The group was ethnically diverse with 31 Caucasian, 22 African American, and 13 Hispanic participants, and 4 participants in the "others" ethnicity category. The majority of the sample (n = 59) had an income of less than $20,000 per year while 11 participants in this group had an income of more than $20,000 per year.

Initial Analyses

After the matching procedures were completed, analyses were conducted to confirm that the HLC and MC groups were not significantly different on the matched demographic variables (see Table 1). The two groups were not significantly different on gender ($\chi^2(1, N = 140) = .000, p = 1.000$), education ($\chi^2(3, N = 140) = .295, p = .961$), ethnicity ($\chi^2(3, N = 140) = 1.017, p = .797$), and income ($\chi^2(1, N = 140) = .040, p = .841$).

In addition to matched variables, the HLC and MC groups were not significantly different on the following demographic variables (see Table 2): age ($t(138) = .333, p = .739$), sexual orientation ($\chi^2(1, N = 140) = .463, p = .496$), and number of stressful life

events in the past six months ($t(135) = -.742$, $p = .459$). As noted, the groups were significantly different on employment status, $\chi^2(3, N = 140) = 26.669$, $p < .0001$, with more of participants in the HLC group on disability.

The HLC and MC groups were also compared on several medical information variables (see Table 3). It is noted that immune data (CD4 cell count and viral load) and past alcohol abuse and dependence data were not collected for the LA sample ($n = 32$) of the HLC group; therefore, analyses on these variables were conducted on a subset of the full HLC sample. Past drug abuse/dependence data was not collected for the LA sample and a portion of participants in the South Florida sample (both HLC and MC groups); a subset of participants from each group was analyzed for these variables. Additionally, the ACTG questionnaire used to measure antiretroviral medication adherence was administered to only a subset of the full sample (HLC $n = 22$; MC $n = 45$), as the measure was under development at the time of this study. The distribution of the HIV viral load variable was positively skewed, and therefore, the variable was transformed using a Log_{10} transformation prior to analysis.

The two groups were not significantly different on the following medical variables: HIV viral load at study entry ($t(106) = 1.252$, $p = .213$), proportion of antiretroviral medication doses missed in the past three days ($t(65) = .042$, $p = .967$), time (in months) since HIV diagnosis ($t(138) = -.301$, $p = .764$), route of HIV infection ($\chi^2(3, N = 140) = 2.939$, $p = .401$), total number of sexually transmitted diseases (STDs) in the past ($t(138) = 1.223$, $p = .223$), and average number of hours of sleep per night in the past week ($t(135) = 1.053$, $p = .294$). As was expected by group definition, the HLC group had significantly lower CD4 cell count at study entry than the MC group, $t(105) = -8.975$,

$p < .0001$. The two groups were also significantly different on antiretroviral medication use at study entry, again as expected by group definition, $\chi^2(2, N = 140) = 12.765$, $p = .002$. The HLC group is defined as having a recorded asymptomatic period of nine months with CD4 cell count below 50. However, it is noted that at the time of study entry, over half (60.53%) of the participants in this group for which immune data was collected ($n = 38$) had CD4 cell counts above 50.

Prior to testing the hypotheses of this study, several analyses were conducted to examine the MHLOC beliefs of various demographic groups (gender and ethnic groups) within the HLC and MC groups. First, the two groups (HLC and MC) were combined to compare males and females on each of the MHLOC subscales. Independent sample t-tests revealed that males and females were not significantly different on any of the four MHLOC subscales: Internal ($t(138) = .044$, $p = .965$), Chance ($t(138) = -.600$, $p = .550$), Doctor ($t(138) = -.550$, $p = .583$), and Other People ($t(138) = 1.467$, $p = .145$). The MHLOC beliefs of four ethnic groups (African Americans, Caucasians, Hispanics, and Others) were also compared. One-way analysis of variance analyses showed that the four ethnic groups were not significantly different on the Internal subscale ($F(3, 136) = 1.324$, $p = .269$), Chance subscale ($F(3, 136) = .935$, $p = .426$), and Doctor subscale ($F(3, 136) = 1.982$, $p = .120$). The ethnic groups were significantly different on the Other People subscale ($F(3, 136) = 4.742$, $p = .004$). Hispanics had the highest average score on the Other People subscale ($M = 9.778$, $SD = 2.913$), followed by Caucasians ($M = 9.233$, $SD = 3.357$), and African Americans ($M = 8.857$, $SD = 4.141$), with the "others" ethnicity having the lowest average score on this subscale ($M = 5.273$, $SD = 2.412$). However, the "others" ethnicity category is comprised of participants of several different ethnic groups.

Therefore, post hoc analysis was not conducted on this finding, as the results would be un-interpretable. A second analysis was conducted to compare ethnic groups on Other People MHLOC beliefs while excluding the "others" ethnicity category. It was found that African Americans, Caucasians, and Hispanics were not significantly different on the Other People subscale, $F(2, 126) = .553$, $p = .577$.

Additionally, several groups widely known as HIV "at-risk" groups were compared on MHLOC beliefs. Individuals fitting the characteristics of the following specified groups were selected from the full sample of HLC and MC groups combined. First, African American males ($n = 29$), African American females ($n = 13$), Caucasian males ($n = 53$), and Caucasian females ($n = 7$) were compared using one-way ANOVA. Results indicate that these groups were not significantly different on any of the four MHLOC subscales: Internal ($F(3, 99) = 1.201$, $p = .314$), Chance ($F(3, 99) = .161$, $p = .922$), Doctor ($F(3, 99) = .735$, $p = .534$), and Other People ($F(3, 99) = .550$, $p = .649$). Finally, one-way ANOVA was used to compare homosexual African American males ($n = 11$), heterosexual African American males ($n = 11$), homosexual Caucasian males ($n = 27$), and heterosexual Caucasian males ($n = 7$). Results showed that these four groups were not significantly different on any of the four MHLOC subscales: Internal ($F(3, 52) = 1.498$, $p = .226$), Chance ($F(3, 52) = 1.256$, $p = .299$), Doctor ($F(3, 52) = .133$, $p = .940$), and Other People ($F(3, 52) = 1.507$, $p = .223$).

Tests of Hypotheses

Comparison of MHLOC Subscales Between Groups. The basic hypotheses of this study center on the idea that there is a relationship between healthy low CD4 status and health locus of control beliefs. Specifically, it is hypothesized that individuals with

healthy low CD4 status (HLC group) will differ from individuals in the matched control (MC group) on particular beliefs about the locus of control over their health, even while controlling for several demographic variables. First, a Hotelling's trace omnibus test was used to assess the significance of difference between the HLC and MC groups on all four of the MHLOC subscale scores simultaneously. Results indicated that the two groups were significantly different in health locus of control beliefs (T^2 = .086, $F(4,135) = 2.894$, $p = .025$). Next, independent samples t-tests were used to examine if the two groups were significantly different for each of the four MHLOC subscales separately (see Table 4a). As hypothesized, the HLC and MC groups were significantly different on the Internal MHLOC subscale ($t(138) = -1.978$, $p = .050$), with the HLC group having lower beliefs in this locus of control ($M = 23.071$, $SD = 5.525$) in comparison to the MC group ($M = 24.943$, $SD = 5.667$). Also as predicted, the two groups were significantly different on Doctors MHLOC beliefs ($t(138) = 2.044$, p = .043), with the HLC group having higher beliefs in this locus ($M = 15.114$, $SD = 3.019$) in comparison to the MC group ($M = 14.029$, $SD = 3.261$). The two groups were not significantly different in their Chance beliefs, $t(138) = .347$, $p = .729$, and Other People beliefs, $t(138) = .419$, $p = .676$. In summary, the HLC group was significantly lower on Internal control beliefs and significantly higher on Doctor control beliefs in comparison to the MC group. Results are presented in Figure 2.

Follow-up analyses were conducted in regard to the findings that the HLC and MC groups were significantly different on Internal and Doctor MHLOC beliefs. Partial correlations were used to address the fact that the two groups were significantly different on the number of participants using antiretroviral medications at study entry, when the

MHLOC was measured (as described in the participant characteristics section). Partial correlations indicated that Internal beliefs continued to be significantly correlated with group status (protected health status) when controlling for antiretroviral medication use at study entry (r = -.170, p = .045), but that Doctor beliefs were no longer significantly correlated with group status (r = .100, p = .242). Next, the HLC and MC samples were combined and separated into two groups: participants who were using antiretroviral medications at study entry (HLC N = 61; MC N = 54), and participants who were not using antiretroviral medications at study entry (HLC N = 9; MC N = 16). Pearson zero-order correlations showed that for participants using antiretroviral medications, there was a significant positive correlation between Doctor beliefs and group status (r = .224, p = .016). However, there was not a significant correlation between group status and Doctor beliefs for participants not using antiretroviral medications (r = -.179, p = .391). In this sample, it appears that higher Doctor MHLOC beliefs are related to protected health status only for individuals who were taking antiretroviral medications at study entry.

MHLOC Subscale Comparisons Within Each Group. The second hypothesis involved an examination of the MHLOC "profile" for the HLC and MC groups separately in order to determine whether beliefs in particular loci of control were significantly higher than other loci for each group (see Tables 5 & 6). A one-way within-subjects ANOVA was conducted for each group with the factor being the MHLOC subscales (each subscale represented one level). For the HLC group, results for the ANOVA indicated a significant main effect, $F(3, 67) = 70.360$, $p < .0001$, $\eta^2 = .759$. Results for the ANOVA also indicated a significant main effect for the MC group, $F(3, 67) = 45.221$, $p < .0001$, $\eta^2 = .669$.

Following the significant main effects, pair-wise comparisons were conducted to assess which MHLOC subscale means differ from each other (see Tables 5 & 6). In the HLC group, the Internal subscale was significantly higher than the Chance subscale ($t(69) = 5.433$, $p < .0001$) and the Other People subscale ($t(69) = 5.581$, $p < .0001$), as hypothesized. Also as hypothesized, the Doctors subscale was significantly higher than the Chance subscale ($t(69) = 13.096$, $p < .0001$) and the Other People ($t(69) = 12.343$, $p < .0001$) subscale. Although not hypothesized, results indicated that the Doctor subscale was significantly higher than the Internal subscale ($t(69) = -9.153$, $p < .0001$) in this sample. The difference between the Chance and Other People subscales in the HLC group was not significant ($t(69) = .060$, $p = .952$).

Although not hypothesized, pair-wise comparison analyses in the MC group indicated the same pattern of results found in the HLC group. In the MC group, the Internal subscale was significantly higher than the Chance ($t(69) = 7.161$, $p < .0001$) and Other People ($t(69) = -3.466$, $p = .001$) subscales. Also, the Doctors subscale was significantly higher than the Chance ($t(69) = -9.696$, $p < .0001$), Other People ($t(69) = 10.095$, $p < .0001$) and Internal ($t(69) = -3.466$, $p = .001$) subscales. The Chance and Other People subscales were not significantly different from each other.

Moderation Analyses. The next set of hypotheses tested was whether particular MHLOC subscales moderated the relationship between other specific MHLOC subscales and group status (HLC vs. MC group; see Table 7). The first hypothesis tested was that Internal MHLOC beliefs moderate the relationship between Chance MHLOC beliefs and group status. Specifically, it was hypothesized that a combination of high Chance and high Internal beliefs would be related to protected health status (HLC group

membership), while a combination of high Chance and low Internal beliefs would not be related to protected health status (MC group membership). In summary, the relationship between Chance control beliefs and group status would depend on the type of Internal control beliefs. A moderator regression model showed that Internal MHLOC beliefs did not significantly moderate the relationship between Chance MHLOC beliefs and group membership, as the interaction effect was not significant.

A second type of analysis was used to further investigate the relationship between group status and the combination of Internal and Chance beliefs (see Table 8). The median value for Internal (*Mdn* = 24) and Chance (*Mdn* = 17) subscale scores were calculated with both groups combined. Participants who had a score at the median value for either subscale were excluded from this analysis, resulting in the exclusion of 8 HLC group members and 9 MC group members. The remaining 123 participants were divided into four categories: low Internal low Chance, low Internal high Chance, high Internal low Chance, and high Internal high Chance. For this analysis, "low" beliefs were defined as below the median value and "high" beliefs as above the median value on the specified subscale. The number of individuals in each of these four categories was calculated for the HLC and MC groups separately. It was hypothesized that there would be a greater frequency of individuals from the HLC group in the "high Chance high Internal" category and a greater frequency of individuals from the MC group in the "high Chance low Internal" category. However, a Chi-square analysis revealed that there was not a significantly different frequency of HLC and MC group members in these four categories, ($\chi^2(3, N = 123) = 3.387, p = .336$).

The second moderation hypothesis tested was that Doctor MHLOC beliefs moderate the relationship between Internal MHLOC and group status (see Table 7). Specifically, it was hypothesized that a combination of high Internal and high Doctor beliefs would be related to protected health status (HLC group membership), while a combination of high Internal and low Doctor beliefs would not be related to protected health status (MC group membership). In summary, the relationship between Internal control beliefs and group status would depend on the type of Doctor control beliefs. Analysis with a moderator regression model showed that Doctors MHLOC beliefs did not significantly moderate the relationship between Internal MHLOC beliefs and group membership, as again the interaction effect was not significant.

The second type of analysis (as described in detail above) was also used to further investigate the relationship between group status and the combination of Internal and Doctors beliefs (see Table 9). Participants from each group were divided into four categories based on the calculated median subscale value for the Internal (*Mdn* = 24) and Doctor (*Mdn* = 15) subscales for the two groups combined. Nine participants from the HLC group and 10 participants from the MC group were excluded from this analysis, as their score on either of the subscales was at the median value. It was hypothesized that there would be a significantly greater frequency of HLC group members in the "high Internal high Doctor" category, and a significantly greater frequency of MC group members in the "high Internal low Doctor" category. A Chi-square analysis revealed that there was a significantly different frequency of HLC and MC group members on these four categories, ($\chi^2(3, N = 121) = 15.535, p = .001$). An examination of the frequency of HLC and MC group members in each of the four categories shows that the two groups

were not significantly different on the "high Internal high Doctor" category and "low Internal low Doctor" categories (see Table 9). As hypothesized, there appears to be a greater frequency of MC group members in the "high Internal low Doctor" category in comparison to the frequency of HLC group members in that category. This combination of MHLOC beliefs is therefore related to being less likely to have protected health status in this sample. Although not hypothesized, there appears to be a greater frequency of HLC group members in the "low Internal high Doctor" category in comparison to the frequency of MC group members in that category. Therefore, this particular combination of MHLOC beliefs is related to protected health status in this sample.

Mediation Analyses. The final set of hypotheses was that several psychosocial variables mediated the relationship between various MHLOC subscales and group membership (dependent variable). Psychosocial variables investigated as mediators included: coping as measured by the COPE (Carver, et al, 1989); perceived stress measured by the Perceived Stress Scale (PSS; Cohen & Williamson, 1988); optimism measured by a composite of the Life Orientation Test (LOT; Scheier & Carver, 1985), and the LOT-R (Scheier, Carver & Bridges, 1994); depression measured by the Beck Depression Inventory (BDI; Beck, et al, 1961); hopelessness as measured by the Beck Hopelessness scale (BHS; Beck, Weissman & Trexler, 1974); and self-efficacy as measured by an iteration of the Self-Efficacy Inventory (SEI) form developed by Ironson and Weiss, et al (2005). Each proposed mediator variable is described in detail in the Methods section.

Prior to running regression analyses to test proposed mediator models, Pearson zero-order correlations were conducted to examine the interrelationships between the

MHLOC subscales, psychosocial variables proposed as mediators, and group status (the dependent variable). It is noted that partial correlations controlling for demographic variables (gender, education, ethnicity, income) were not necessary, as the two groups were matched on these variables prior to conducting all analyses. Full mediation analyses were conducted when Pearson zero-order correlation analyses revealed that the proposed mediator variable significantly correlated with the MHLOC subscale and group status, and when the MHLOC subscale also significantly correlated with group status. For the group status variable, the HLC group was labeled = 1, and the MC group was labeled = 0. Therefore, a positive correlation with group status indicates a positive relationship with HLC group membership (i.e., protected health status), and a negative correlation indicates a negative (inverse) relationship with HLC group membership.

First, Pearson zero-order correlation analyses revealed that group status (i.e., protected health status) was significantly negatively related to Internal MHLOC (r = -.166, p = .050, N = 140), and significantly positively related to Doctors MHLOC (r = .171, p = .043, N = 140). Group status was not significantly related to Chance MHLOC (r = .029, p = .729, N = 140) or Other People MHLOC (r = .036, p = .676, N = 140). The relationship between group status and the MHLOC subscales is presented in Table 8.

Pearson zero-order correlation analyses also showed a significant negative relationship between group status/protected health status and affective depression, as measured by the affective subscale of the BDI (r = -.190, p = .025, N = 139). For all other psychosocial variables hypothesized as mediators, Pearson correlations revealed that there were not significant relationships with group status (p > .05). The

interrelationships between group status and hypothesized mediator variables are presented in Table 9.

The relationship between hypothesized mediator variables and each of the MHLOC subscales was also examined with Pearson zero-order correlation analyses (see Table 9). Internal MHLOC beliefs were significantly correlated with self-efficacy for lifting negative mood ($r = .221$, $p = .009$, $N = 138$), action-oriented self-efficacy ($r = .219$, $p = .010$, $N = 138$), and AIDS self-efficacy ($r = .274$, $p = .001$, $N = 138$), and significantly negatively correlated with hopelessness ($r = -.193$, $p = .023$, $N = 139$). Chance MHLOC beliefs were significantly correlated with affective depression ($r = .193$, $p = .022$, $N = 139$), and optimism ($r = .176$, $p = .038$, $N = 140$), and significantly negatively correlated with adaptive coping ($r = -.216$, $p = .010$, $N = 140$), self-efficacy for lifting negative mood ($r = -.204$, $p = .016$, $N = 138$), and action-oriented self-efficacy ($r = -.183$, $p = .031$, $N = 138$). Doctors MHLOC beliefs were significantly correlated with adaptive coping ($r = .291$, $p < .0001$, $N = 140$), self-efficacy for lifting negative mood ($r = .227$, $p = .007$, $N = 138$), action-oriented self-efficacy ($r = .327$, $p < .0001$, $N = 138$), and AIDS self-efficacy ($r = .222$, $p = .009$, $N = 138$), and was significantly negatively correlated with affective depression ($r = -.185$, $p = .029$, $N = 139$), perceived stress ($r = -.183$, $p = .031$, $N = 140$), optimism ($r = -.313$, $p < .0001$, $N = 140$), and hopelessness ($r = -.242$, $p = .004$, $N = 139$). Other People MHLOC beliefs were significantly correlated with overall depression ($r = .194$, $p = .022$, $N = 139$), and affective depression ($r = .178$, $p = .036$, $N = 139$), and was significantly negatively correlated with avoidant coping ($r = -.170$, $p = .045$, $N = 140$), and self-efficacy for lifting negative mood ($r = -.226$, $p = .008$, $N = 138$). All other Pearson correlations between the MHLOC subscales and

hypothesized mediator variables were not significant ($p > .05$) and are presented in Table 9.

Depression (affective subscale of the BDI) was the only hypothesized mediator that was significantly correlated with group status. Therefore, full regression analysis was conducted to test the hypothesis that affective depression mediates the relationship between Doctor MHLOC and group status (see Table 12). All reported coefficients are un-standardized. First, group status was significantly regressed on Doctor MHLOC ($B = .027$, $t(138) = 2.044$, $p = .043$). Next, affective depression was significantly regressed on Doctor MHLOC ($B = -.300$, $t(137) = -2.207$, $p = .029$). Finally, group status was regressed on Doctor MHLOC and affective depression. Affective depression was identified as a mediator of the relationship between Doctor MHLOC and group status because the beta weight associated with affective depression in this last regression equation was significant ($B = -.016$, $t(136) = -1.946$, $p = .054$) and the beta weight associated with Doctor MHLOC (which was significant in the first regression equation) was no longer significant ($B = .021$, $t(136) = 1.582$, $p = .116$). A Sobel test was used to test the significance of this mediation effect; the calculated test value ($z = 1.48$) was somewhat below the critical value ($z = 1.96$) needed to indicate a significant mediation effect. Therefore, this finding will be interpreted as a trend for affective depression acting as a mediator in the relationship between Doctor control beliefs and protected health status (see Figure 3).

An examination of descriptive statistics helps with interpretation of the mediation trend discovered. The HLC group was lower in average affective depression ($M = 4.043$, $SD = 3.942$) compared with the MC group ($M = 5.993$, $SD = 5.975$), and the HLC group

was higher in Doctor MHLOC beliefs (M = 15.114, SD = 3.019) compared with the MC group (M = 14.029, SD = 3.261), as previously mentioned. These results indicate that HIV-positive individuals who have higher beliefs that doctors control their health are less depressed, and this seems to be protective of health even for individuals with low CD4 cells before the advent of HAART medications.

Finally, to determine whether innate immune functioning mediated the relationship between health locus of control beliefs and group status, measures of Natural Killer cell number (NK#) and cytotoxicity (NKCC) were examined. This immune data was only available for a subset of the full sample (HLC N = 30; MC N = 28). Zero-order Pearson correlations showed that the four MHLOC subscales were not significantly correlated with NKCC: Internal (r = -.004, p = .977); Doctor (r = .036, p = .787); Chance (r = .022, p = .871); and Other People (r = -.020, p = .882). Additionally, the four subscales were not significantly correlated with NK#: Internal (r = -.096, p = .473); Doctor (r = -.112, p = .403); Chance (r = -.031, p = .818); and Other People (r = .055, p = .684). Because there was no relationship between these immune markers and MHLOC beliefs, and regression analyses were not needed to test the hypothesis that NK# and NKCC mediate the relationship between MHLOC and group status.

Validity Check. As described in detail in the Methods section, the MHLOC was administered to a separate sample of HIV-positive individuals (N = 30) in order to verify the validity of administration procedures in this study. Results indicate that the majority of the participants (63.3%) interpreted the term "condition" in each item of the MHLOC as entirely meaning HIV. An additional 30.0% of the sample interpreted the term "condition" as meaning partly HIV and partly other things, and only 6.7% of the sample

interpreted this term as meaning completely something other than HIV. Therefore, it appears that the majority of HIV-positive research participants appropriately interpret and respond to the items of the MHLOC without specific verbal instructions indicating the term "condition" as meaning HIV.

Discussion

The main goal of this study was to examine the relationships between health locus of control beliefs and protected health status in HIV-positive individuals. The primary focus was on a rare group of HIV-positive individuals who were healthy despite very low CD4 cells without the aid of protease inhibitors (healthy low CD4 (HLC) group). The health locus of control beliefs of this group were examined and compared to the beliefs of a matched control group of HIV-positive individuals in the mid-range of disease progression (matched control (MC) group). Additionally, several psychosocial variables were investigated as potential moderators or mediators in the relationship between MHLOC beliefs and protected health status (group membership). To date, no studies in the available literature have examined health locus of control beliefs in this unique group of HIV-positive individuals, and there are very few published studies examining the MHLOC in relation to HIV disease progression markers.

As hypothesized, the two groups (HLC and MC) were significantly different on their Internal MHLOC beliefs. However, the direction of this finding was somewhat surprising, in that the group identified as having protected health status (HLC) had lower Internal MHLOC beliefs in comparison to the MC group. In contrast with the present finding that lower Internal beliefs were related to protected health status, most studies in HIV-positive populations have shown that higher Internal beliefs are related to more adaptive health status. One study with HIV-positive individuals found that higher baseline Internal beliefs were associated with higher self-report physical quality-of-life at 44-month follow-up (Preau, et al., 2005), and another study found that higher Internal HLOC was associated with better perceived health (Simoni & Ng, 2002). In the context

of antiretroviral medications, one study found that HIV patients in Hong Kong with higher Internal beliefs had higher medication adherence (Molassiotis, et al., 2002). However, there are a few possible explanations for the present result indicating a relationship between protected health status and lower Internal beliefs.

One notable factor kept in mind while interpreting this surprising result is that the health status of the HLC group was not "better" per se in comparison to the MC group. The HLC group most definitely had a protected health status, as they were asymptomatic without taking protease inhibitors despite having very low CD4 cell counts. Nonetheless, this group did have a severely compromised immune system, and were labeled as experiencing a later stage of HIV disease progression. Thus, one possibility for the finding that the HLC group was lower on Internal beliefs would be that an individual's MHLOC beliefs may change throughout the course of an illness. Schempp (1995) found that HIV-positive military members in later stages of HIV progression had lower Internal beliefs than individuals in earlier stages of the illness. Perhaps the HLC sample had different beliefs on this dimension due to their experience with an advanced stage of HIV, in comparison to the individuals with mid-range disease progression who comprise the MC group. Future research designs following MHLOC beliefs longitudinally in HIV populations are needed to provide information about whether these beliefs change with disease progression, as well as understanding of the pathways thru which these changes may occur.

Although the aforementioned studies aid in the interpretation of the present findings, direct comparison with other research is limited, as there are no studies to date that have investigated the relationship between MHLOC beliefs and immunologic

markers of health status in an HIV-positive population. Therefore, findings in research of MHLOC beliefs for other medical populations will allow for further interpretation.

There is evidence in studies with other medical populations that higher Internal MHLOC beliefs can be more adaptive. For example, higher Internal beliefs were related to increased survival rates in lung transplant recipients (Burker, et al, 2005), and related to better medical regimen adherence in diabetes patients (O'Hea, et al, 2005). Many studies have found that higher internal beliefs are predictive of better psychosocial adjustment. This conclusion has been made in studies with cancer patients (Sun & Stewart, 2000; Blood, et al, 1993), individuals during end-stage renal disease (Pucheu, et al, 1993), chronic pain patients (Crisson & Keefe, 1988), and individuals with spinal-cord injury (Frank, et al, 1987).

However, it is noted by the developers of the MHLOC that in many chronic illness populations, simultaneously high Internal and Doctor beliefs may be more adaptive, as the need to listen to the advice of one's doctor becomes increasingly important (Wallston, et al, 1982). In line with this theory, there is a growing body of evidence showing that in some cases, high external beliefs may be equally or more adaptive as high internal beliefs for individuals with various medical conditions. For example, higher external beliefs have been associated with better psychological adjustment in cancer patients (Burish, et al, 2004). The role of Internal beliefs may depend on other factors involved in an individual's medical status. In a study with early-stage breast cancer survivors, Internal beliefs were associated with higher rates of depression for individuals with high levels of anxiety (Naus, et al, 2005). In a study with end-stage renal disease patients, higher Internal beliefs were associated with greater

depression levels in patients experiencing a failed transplant (Christensen, et al, 1991). Conversely, for patients who did not receive a wanted transplant, higher Internal beliefs were associated with lower depression levels. It is conceivable that the HLC group of the current study is in some ways parallel to the failed transplant group of the Christensen study. These individuals may have felt that their health was failing (an interpretation that could easily go with watching one's CD4 cells plummet), and having the belief that one is personally responsible for this failure (high Internal beliefs) may not have been adaptive in that situation.

As hypothesized, the HLC and MC groups were also significantly different in Doctor MHLOC beliefs. In this case, the direction of the group difference was consistent with the hypothesis, in that higher Doctor control beliefs were related to protected health status (HLC group) in comparison to the beliefs of the matched control group. There are no studies in the available literature relating Doctor control beliefs to immune markers indicating protective health status in HIV-positive populations. In fact, there are no studies in the available literature measuring Doctor health locus of control beliefs (Form C MHLOC) in HIV-positive populations. The forms used in other studies with this population did not have a separate Doctors subscale, but had items measuring the belief of doctors as a locus of health control subsumed under the subscale "Powerful Others". Therefore, previous studies with relevant findings for the Powerful Others subscale with HIV populations will be reviewed. However, the interpretation of these findings in relationship to the present study is limited, as the Powerful Others subscale also measures beliefs in other important people as a locus of health control. The need for more research

using Form C MHLOC in HIV populations in order to understand the role of Doctor control beliefs is clearly brought forth by the present situation.

Several studies have shown a relationship between Powerful Others control beliefs and adaptive health behaviors in HIV-positive populations. One study found that HIV-positive gay men who belonged to a support group had higher Powerful Others beliefs (which includes Doctor control belief items) in comparison to individuals who did not belong to a support group (Fontaine, et al, 1997). Fontaine (1997) points out that in comparison to healthy populations, it may be more adaptive and realistic for HIV-positive individuals to recognize the importance of their doctor's role in health outcomes in addition to their own control. Another study found that individuals who were taking a protease inhibitor (PI) were more likely to have high Powerful Others beliefs than individuals who were not taking a PI, while controlling for age, CD4 cell count, HIV viral load, and number of HIV physical symptoms (Evans, et al, 2000). In this article, the researcher noted that the Powerful Others HLOC items relating to doctors and health professionals were significantly endorsed by patients using a PI, which pulls into focus the importance of the "doctor-patient" relationship in decisions regarding medication use for HIV positive individuals. In a study with HIV-positive Latinos, higher Powerful Others beliefs were associated with better self-report mental health ratings (Burns, et al, 2005). In contrast to the present findings, Simoni & Ng (2002) found that higher Powerful Others beliefs were associated with worse perceived health in a sample of HIV-positive women. While there are some mixed findings, the majority of evidence suggests higher Powerful Others control beliefs as related to adaptive health behavior and status in HIV populations. It seems possible that Doctor control beliefs especially may be related

to more adaptive health, but this has not yet been tested apart from Powerful Others control beliefs in this population.

From a theoretical standpoint, it makes sense that individuals who strongly believe that health care professionals control their health would be more likely to follow the advice of their doctors. This could include following a doctor's directions for properly taking antiretroviral medications, and medication adherence is widely known as a huge factor in disease progression and health status for individuals with HIV. However, in the present study participants in the HLC group met the unique status of being healthy despite low CD4 cells at a time when HAART medications were not available. Therefore, it is not possible that better medication adherence was involved in the protected health status experienced by these individuals at that time. Regardless, the impact of Doctor control beliefs on doctor-patient relationship and medication adherence is an area needing further elucidation in future research. Overall, the evidence is growing that there is a relationship between Powerful Others control beliefs (which include Doctor control beliefs) and health outcomes in HIV populations, with the exact nature and pathways of that relationship still being refined today.

Additionally, follow-up analyses regarding antiretroviral medication use at study entry added to the interpretation of group differences in Doctor MHLOC beliefs. It was determined that the groups were significantly different on the number of individuals using antiretroviral medications at study entry, with more people in the HLC group using these medications. For individuals not using antiretroviral medications, there was no relationship between protected health status (group status) and Doctor beliefs. However, for individuals who were taking medications, higher Doctor control beliefs were related

to protected health status. It may be that Doctor control beliefs are more important once individuals begin an antiretroviral medication regimen. Theoretically, this seems logical, as doctors are an important source of knowledge and control in the initiation and management of antiretroviral medication use and adherence. Therefore, the significantly higher Doctor beliefs of the HLC group may be accounted for by the fact that more individuals from this group were taking antiretroviral medications at the time when MHLOC beliefs were measured (i.e., at study entry). In summary, Doctor control beliefs may only be important for HIV-positive individuals who are taking antiretroviral medications, and are not important for individuals who are not taking these medications.

Although it was hypothesized that the HLC group would have significantly lower Chance and Other People control beliefs in comparison to the MC group, the two groups were not different on these two subscales. An interpretation of this finding leads into the next set of hypotheses investigated, where the MHLOC "profile" was examined within each group separately. For the HLC and MC groups, Chance and Other People were both equally the lowest dimensions of health locus of control beliefs. It appears in this sample that fate, chance, luck and important people in one's life are not believed to be strongly in control of one's health, regardless of group status. Perhaps the relatively low level of belief in these two loci of control is more strongly influenced by being HIV positive than by severity of disease. Furthermore, the most strongly endorsed locus of control for both groups was the Doctors dimension, with Internal control beliefs coming in second for both groups. Overall, the two groups had the same "profile" of MHLOC beliefs despite their significant differences on the Internal and Doctors subscales, as visually represented in Figure 2.

In comparison to data collected on another large, diverse sample of HIV-positive individuals ($N = 302$; Preau, et al, 2005), the HLC and MC groups of the present study both had higher average Internal beliefs and higher average Chance beliefs. The reason for our sample being higher on these two dimensions of control in comparison to another HIV-positive sample is unknown. The average Internal beliefs of the HLC group were slightly lower in comparison to a large sample of healthy individuals representing "normative" MHLOC data (Wallston, et al, 1978), while the Internal beliefs of the MC group were quite similar to those of this healthy sample. Perhaps the experience of an advanced disease stage is related to the difference in level of Internal beliefs for the HLC group, while the MC group was more similar in Internal beliefs to healthy individuals. The Chance beliefs of the HLC and MC groups were both higher relative to this normative sample of healthy individuals. This may be because control beliefs in healthy populations are usually geared towards preventative health measures, which may be viewed as less related to chance, fate and luck by this population. Conversely, health locus of control beliefs in chronic medical populations (i.e., HIV) are usually related to health status and outcomes related to one's particular medical condition. This difference may be a cause of the disparity in level of chance control beliefs for these two populations.

It is not possible to compare the Doctor and Other People dimensions for the present study with those of other HIV samples. These two subscales are unique to Form C MHLOC and all other studies published for HIV-positive populations have used Forms A or B, where the two dimensions are combined into a "Powerful Others" subscale. Therefore, the scores on these dimensions for the samples of the present study will be

compared to samples from studies with other medical populations where Form C was used. In comparison to a large sample of breast cancer survivors (Naus, et al, 2005), the HLC group had similar average Doctors beliefs, and the MC group had just slightly lower Doctor beliefs. The HLC and MC groups both had noticeably higher average Doctor beliefs in comparison to a sample of chronic pain patients (Wallston, et al, 1994). It may be that the role of physicians in managing particular medical conditions (i.e. breast cancer) is more similar to HIV than in other medical conditions (i.e., chronic pain). Hence, this may explain the similarity in Doctor control beliefs with some medical populations and not with others. On the Other People subscale, the average scores for the HLC and MC samples were both quite similar to those of the breast cancer and chronic pain sample. Other People beliefs may not differ greatly across various types of medical populations.

The next set of hypotheses, that the interaction of particular MHLOC subscales would predict protected health status (group membership), did not generate positive results. Specifically, Internal beliefs did not moderate the relationship between Chance beliefs and group status, and Doctor beliefs did not moderate the relationship between Internal beliefs and group status, as was hypothesized. The idea of testing the interaction of MHLOC subscales as a predictor of group status was based on a study with diabetes patients (O'Hea, et al, 2005), where subscale interactions were found as significant predictors of medical regimen adherence. Specifically, O'Hea, et al (2005) found that individuals with a combination of high Chance and low Internal beliefs had the worst adherence rates, and individuals with a combination of low Other People and low Chance

beliefs had the best adherence rates. There are no previous studies in the available literature examining the interaction of MHLOC subscales in an HIV-positive population.

Although the hypothesized subscale interactions were not found to be significant in the present study, a further investigation revealed that particular combinations of MHLOC beliefs were related to protected health status in this population. Once the participant scores were dichotomized into "high" and "low" levels of control beliefs on the relevant dimensions, it was found that there was a significant effect for the combination of Internal and Doctor beliefs. Specifically, the combination of low Internal and high Doctor beliefs appears to be related to protected health status, while individuals with a combination of high Internal and low Doctors beliefs appear less likely to have protected health status. However, there appears to be no relationship between a combination of Internal and Chance beliefs and protected health status in this sample.

The final set of hypotheses was that several psychosocial variables would mediate the relationship between particular MHLOC beliefs and protected health status (group membership). The following variables did not mediate the relationship between Internal control beliefs and protected health status: depression, coping, hopelessness, optimism, perceived stress and self-efficacy. Additionally, hopelessness and optimism did not mediate the relationship between Chance control beliefs and group status, and social support and coping (avoidant and adaptive) did not mediate the relationship between Other People control beliefs and group status, as was hypothesized.

However, a preliminary examination of the interrelationships between the MHLOC subscales, potential mediators, and group status led to one surprising finding that was not originally hypothesized. It was discovered that although not quite

statistically significant, there was a trend showing affective depression (affective subscale of the BDI) as a mediator in the relationship between Doctor health locus of control beliefs and group status. Specifically, having stronger beliefs that doctors are in control of one's health is related to lower affective depression and related to healthy low CD4 status (protected health status). It is noted that the affective subscale of the BDI was selected as a measure of depression because it is often a more accurate representation of depression in medical populations, where illness-related symptoms can be confounded with the somatic symptoms of depression measured by the somatic subscale of the BDI.

In order to interpret the level of depression experienced by the samples of the present study, the average scores of other populations were examined and used as a point of comparison (see Tables 14a and 14b). In one study with a small but diverse sample, the average BDI affective subscale score of an HIV-negative group was slightly lower than the average score for the MC group, and was higher than the average score of the HLC group (Table 14a; Castellon, Hinkin, Wood, & Yarema, 1998). Additionally, for two groups of HIV-positive individuals (one identified as "pre-AIDS" and another identified as having AIDS) the average score on this dimension was noticeably higher than the average scores of the HLC or MC groups. Interestingly, the "pre-AIDS" group in this study had the highest average affective depression score, with the AIDS group scoring slightly lower. This finding is parallel in ways to the present study, where the HLC group (individuals with AIDS) was significantly lower in affective depression than the group in the mid-range of HIV disease progression (MC group). Another study comprised mostly of gay, Caucasian men, examined the BDI affective scores of an asymptomatic group with the scores of a group comprised of individuals who were

symptomatic and/or had AIDS (Table 14b; Savard, Laberge, Gauthier, Ivers & Bergeron, 1998). In this case, it was the group in a more advanced disease stage that had the higher affective depression scores. The asymptomatic group had slightly higher average scores compared to the HLC group, and slightly higher scores than the MC group. The symptomatic/AIDS group had higher average affective depression scores than the HLC group, and slightly higher scores than the MC group. The relationship between HIV disease stage and level of affective depression in this sample appears complex, and a better understanding may follow from continued investigation in future research.

The finding that protected health status was related to lower depression and higher Doctor control beliefs seems consistent with Wallston's (1994) theory that it may be adaptive for individuals living with a chronic illness to have strong beliefs in doctors as being in control of one's health. In the case of the HLC group, it may have been better to relinquish control of one's health to the responsibility of medical professionals. It is plausible that the burden of viewing oneself as primarily and/or solely in control of managing a chronic illness such as HIV could be associated with poorer psychological adjustment (including depression), especially in the face of later disease stages. Accordingly, there is a substantial body of evidence linking depression to faster disease progression in HIV populations (Ironson, et al, 2005; Leserman, et al, 2002). As illustrated above, the HLC group had a relatively low level of affective depression in comparison to not only the MC group, but also in comparison to other HIV-positive samples and an HIV-negative sample. Theoretically, it is somewhat surprising that these individuals were not more depressed, given their situation of having a severely compromised immune system at a time when HAART medications were not available.

The health locus of control beliefs of this group (strong Doctor control beliefs in particular), may be a part of the psychosocial picture contributing to this relatively low level of depression.

Study Limitations

The group of HIV positive individuals investigated in this study was identified as unique based on their experience of asymptomatic status despite very low CD4 cells during a time before HAART was available. HIV-positive individuals with this immune profile today are prescribed HAART by any treating physician, and therefore, individuals with "healthy low CD4" status are no longer easily identified. This should be kept in mind as a limitation in the generalization of these findings to other HIV-positive samples. Additionally, it is noted that at the time of study entry many of the HLC group participants were taking antiretroviral medications. In fact, the number of individuals in this group who were taking antiretroviral medications was significantly higher than the number of participants in the matched control group who were taking these medications. As previously described, this group difference may account for the finding that the HLC group had higher Doctor control beliefs. The disparity between the present samples on antiretroviral medication use should be kept in mind as a limitation of these findings.

Another limitation of this study was the disparity between groups on employment status. As described in detail in the Methods section, various attempts were made to match the two groups on employment in addition to the other demographic variables originally chosen for matching (gender, education, and ethnicity). However, it was not possible to match the two groups on this variable due to the very high frequency of individuals in the HLC group who were on disability (see Table 2). Although the groups

are quite different on this variable, it should be kept in mind that disability status is confounded by the fact that the HLC group was at a later stage of illness by group definition, and therefore these individuals were more likely to be placed on disability. In order to somewhat resolve this limitation, yearly income replaced employment as the fourth matching variable, as it is a more appropriate marker of socioeconomic status in this sample.

Another possible limitation in interpreting the present finding is that there may be some relationship between MHLOC beliefs and the choice to participate in a research study investigating psychosocial factors in HIV. Although information about such relationships is not known, it is conceivable that individuals with higher Internal MHLOC beliefs may be more likely to participate in this type of research, as a form of proactive behavior related to their medical condition. The influence of MHLOC beliefs on the choice to participate in research should be borne in mind as a limitation in the generalization of the present findings to other samples of HIV-positive individuals.

The design of this study was cross-sectional, and consequently, any formal conclusions about the causality of associations between variables must be ruled out. Associations between protected health status in HIV and the established variables of interest are suggested by the results of this investigation, but causality cannot be established. It is noted that the significant relationships that came into view during this examination are associate and are not being presented as either causative or predictive.

Directions for Future Research

There are several psychosocial variables not included in the present study that could provide a better understanding of the relationship between health locus of control

beliefs and health status for HIV-positive populations in future research. A measure of the desirability for control would provide information about the degree to which HIV-positive individuals prefer to have control over situations in their life versus putting control into the hands of other sources. This tool would be particularly helpful in interpreting findings with the Internal MHLOC subscale. For example, it is possible that for individuals with low desirability for control, low Internal beliefs and higher external beliefs may be more adaptive. An investigation of God health locus of control beliefs (Wallston, et al, 1999) in this sample may also provide interesting information in future research, as this dimension of control was not measured in the present study. Finally, a measure of health value (the degree to which one values their health) may also bring forth new information in future studies with this population. The developer of the MHLOC scales has noted that a measure of health value can be quite useful in the interpretation of the relationship between control beliefs and health behaviors (Wallston, et al, 1991). In summary, the addition of these measures to the psychosocial battery of future studies may add to the interpretation of the present findings.

Based on the associations between health locus of control beliefs and health status in HIV found in the present study, several different study designs would provide an opportunity to examine additional aspects of the relationship between these constructs. The present study compared a group of individuals who were asymptomatic despite low CD4 cells with a group of individuals in the mid-range of disease progression. A design comparing MHLOC beliefs of the HLC group with individuals who had low CD4 cells and were symptomatic would be an interesting comparison for future research. To best

understand the relationship between MHLOC beliefs and HIV disease progression, a longitudinal study design would be employed.

Are Health Locus of Control Beliefs Modifiable? Once relationships between particular MHLOC beliefs and HIV disease progression have been thoroughly established, a clinical intervention study design could perhaps best serve the HIV community. The intervention design could address changing maladaptive MHLOC beliefs and fostering adaptive beliefs in this population. Although MHLOC beliefs are often viewed as trait-like, the innovator of this family of scales points out that in fact these beliefs are more of a state-trait (Wallston, 1982).

The findings of some recent research studies have further bolstered the notion that health locus of control beliefs can change over time. For example, chronic kidney disease patients whose Internal beliefs increased over the course of one year showed lower levels of depression from baseline measurement (Cvengros, et al, 2005). In fact, several intervention studies have been successful in modifying health locus of control beliefs. In one study, adolescents showed greater internal and lower external HLOC after a 5-session HIV risk-reduction intervention, in addition to increases in HIV/AIDS knowledge, increased self-efficacy, and more favorable attitudes towards prevention and condom use (St. Lawrence, Jefferson, Banks, & Cline, 1994). A group of Hispanic children showed an increase in Internal beliefs and decrease in powerful others beliefs participation in an educational intervention focused on communication, behavior management, and cultural appreciation (Vincent & Guinn, 2001). In a sample of adult chronic pain patients, Internal beliefs significantly increased while all three external types of belief (Doctors, Chance, and Other People) decreased after a 6-week behaviorally

oriented pain management program designed to weaken participant's beliefs of pain helplessness (Wallston, et al, 1994). In another study, participants from a large sample of older adults with chronic illness were randomly assigned to a mind/body wellness intervention. The intervention group showed significant decreases in Chance and Powerful Others MHLOC beliefs as well as significant decreases in self-reported sleep difficulties, pain, anxiety, and depression symptoms compared with the control group. At one-year follow-up, sleep benefits and changes in control beliefs were still maintained along with an increase in health behaviors compared to the control group, but benefits in pain, anxiety, and depression were not maintained (Rybarczk, DeMarco, DeLaCruz, Lapidos & Fortner, (2001). In summary, the body of evidence showing that health locus of control beliefs can change over time is growing.

Clinical Implications

As health locus of control beliefs appear to be related to protected health status in this sample, the inclusion of this construct in thorough psychosocial assessments of HIV-positive individuals may be beneficial. The present findings also suggest that higher Doctor control beliefs may be related to lower affective depression and related to protected health status. Therefore, health and mental health care providers might consider high Doctor control beliefs as a possible sign of better psychosocial adjustment (lower depression), and therefore better prognosis in HIV-positive patients. Conversely, providers may consider low Doctor control beliefs as an indicator of greater risk for depression in this population.

Although the predominant message reflected in the current literature is that higher Internal control beliefs alone are most adaptive, the present study brings this notion into

question. The finding that higher Doctor control beliefs were related to protected health status in this sample points to the need for a good understanding of the contextual factors the may come into play when interpreting control beliefs. The intricacies of control beliefs for specific medical populations need to be well understood before this construct is used to guide the care and management of patients.

There is an increasing amount of evidence showing that health locus of control beliefs may be changed thru psychosocial interventions. As outlined previously, the majority of intervention designs aimed at changing MHLOC beliefs have intended to decrease external control beliefs and increase internal beliefs, and in many cases these studies have proven quite successful in this attempt. However, the findings of the present study, along with those of several other studies (as previously reviewed) brings into question the notion that increasing internal beliefs and decreasing external beliefs is best for all populations. In some cases, it may be that external beliefs (Doctor control beliefs in particular) are related to healthy behaviors and/or protected health status. The understanding of how individuals in specific subsets of the HIV-positive population believe their health is controlled could lend guidance for intervention measures aimed at optimal health status.

Contributions and Conclusions

The results of this study have shown that particular health locus of control beliefs are related to protected health status and affective depression. This evidence adds to the limited information available about a rare group of individuals who were asymptomatic despite very low CD4 cells without the aid of protease inhibitors. Specifically, these findings show that psychosocial factors are relevant in understanding the protected health

status experienced by this unique group of HIV-positive individuals. Furthermore, Ironson & Hayward (in press) have noted control beliefs as one of the many positive psychosocial factors needing further examination as potentially protective factors in health. This study is a step towards filling the gap in research about the positive psychological resources that help to keep people healthy.

At this time, research on health locus of control beliefs in HIV-positive populations is not abundant. In particular, there are no studies to date that have examined this construct in relation to protected health status and disease progression in this population. The present finding that MHLOC beliefs were related to protected health status in a cross-sectional design brings new evidence to this area of research. Furthermore, it points to the need for investigations with a longitudinal design where relationships with HIV disease progression will be brought forth.

One notable contribution of the present study is the use of Form C MHLOC in a diverse HIV-positive population. Although Form C was developed for the purpose of more accurately measuring health locus of control beliefs in medical populations, researchers continue to use the more general Forms A and B. As we are the first study to use Form C in this population, our findings provide data on Doctor and Other People control beliefs that may be used as a basis for comparison with other samples. The fact that Doctor control beliefs were central to the significant findings in this study confirms the value of specifically measuring this type of belief in studies with HIV-positive individuals

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Figure 1 Hypothesized Model Relating Health Locus of Control Beliefs to Protected Health Status in HIV

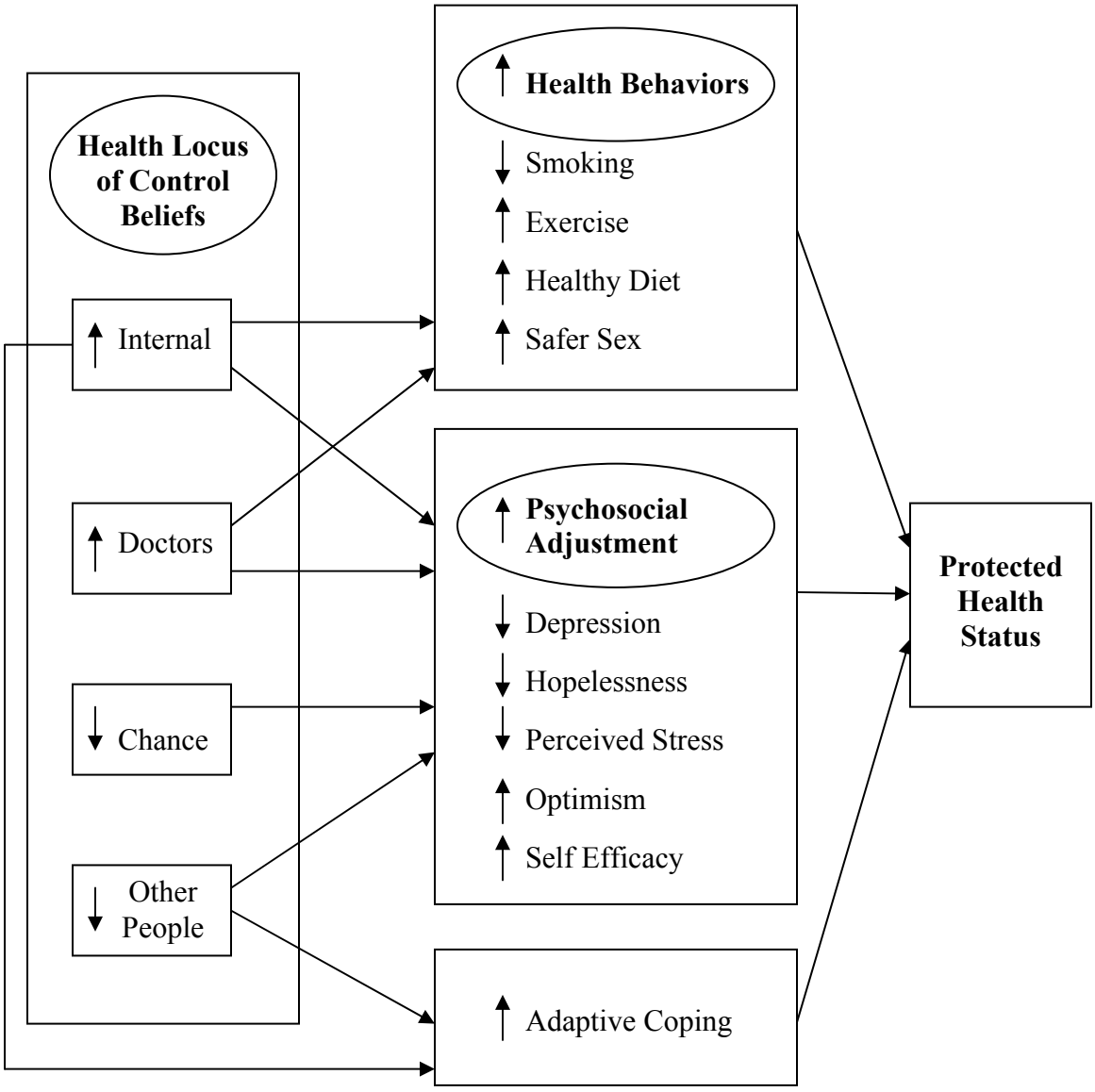
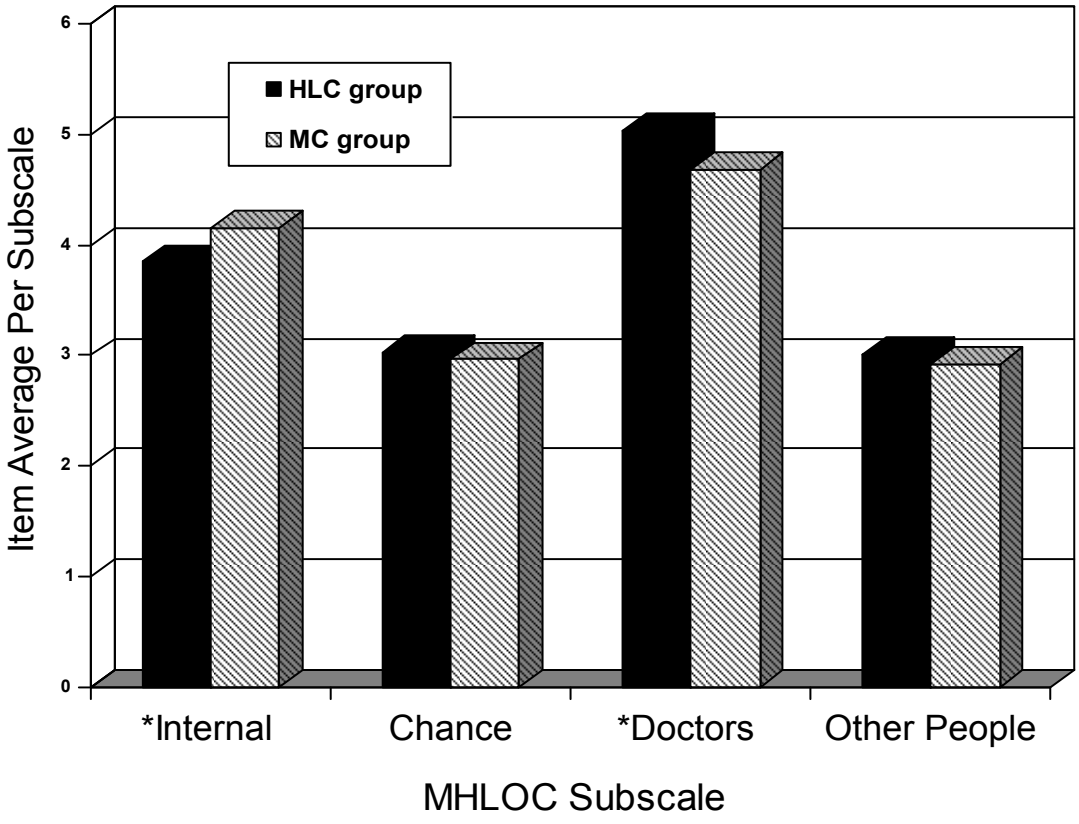
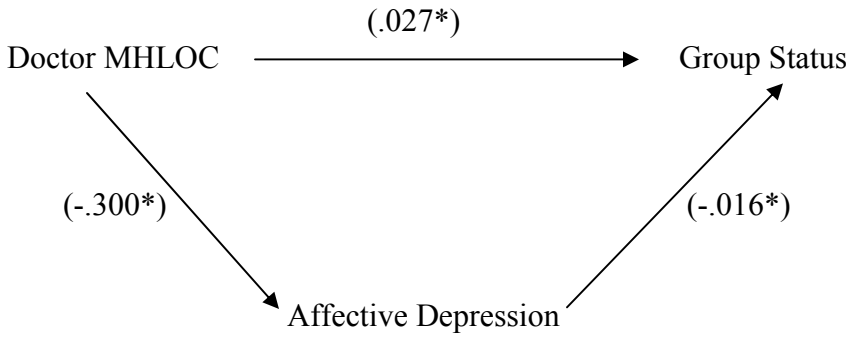


Figure 2 MHLOC Subscale Item Average for HLC and MC Groups



*$p \leq .05$; **$p < .01$; ***$p < .001$

Figure 3 Path Diagram Model for Testing Affective Depression as a Mediator of the Relationship between Doctor MHLOC and Group Status



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*$p \leq .05$; ns = not significant
numbers in parentheses are un-standardized beta coefficients in models with Group Status as the dependent variable and Doctor MHLOC and Affective Depression (affective subscale of the BDI) as independent variables

Table 1 Matched Demographic Variables Compared Between HLC and MC Groups

	HLC group	MC group	Significance
Gender			
Male	77.1%	77.1%	$\chi^2 = .000$
Female	22.9%	22.9%	$df = 1$
			$p = 1.00$
Education			
<8th Grade/Some HS	7.1%	8.6%	$\chi^2 = .295$
High School Grad	14.3%	12.9%	$df = 3$
Trade School/Some College	48.6%	45.7%	$p = .961$
College Grad/Grad Degree	30.0%	32.9%	
Ethnicity			
Caucasian	41.4%	44.3%	$\chi^2 = 1.017$
African American	28.6%	31.4%	$df = 3$
Hispanic	20.0%	18.6%	$p = .797$
Others	10.0%	5.7%	
Income			
< $20,000/year	84.3%	84.3%	$\chi^2 = .000$
> $20,000/year	15.7%	15.7%	$df = 1$
			$p = 1.00$

*$p < .05$; **$p < .01$; ***$p < .001$

Table 2 Other Demographic Variables Compared Between HLC and MC Groups

	HLC group	MC group	Significance
Employment			
Full-Time	4.3%	18.6%	$\chi^2 = 26.699$
Part-Time	2.9%	17.1%	$df = 3$
Disability	84.3%	42.9%	$p < .0001$***
Other	8.6%	21.4%	
Sexual Orientation			
Gay/Bisexual/Other	52.9%	58.6%	$\chi^2 = .463$
Heterosexual	47.1%	41.4%	$df = 1$
			$p = .496$
Age			
Mean	38.26	37.83	$t = .333$
(SD)	(6.312)	(8.714)	$df = 138$
			$p = .739$
Stressful Life Events in Past 6 Months			
Mean	3.015	3.343	$t = -.742$
(SD)	(2.345)	(2.797)	$df = 135$
			$p = .459$

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3 Medical Information Compared Between HLC and MC Groups

	HLC group	MC group	Significance
CD4 Cell # at Study Entry			
Mean	114.053	313.522	t = -8.975
(*SD*)	(118.869)	(104.883)	df = 105
			$p < .0001$***
Viral Load at Study Entry			
Mean	97549.789	60032.314	t = 1.252
(*SD*)	(155149.119)	(145163.295)	df = 106
			$p = .213$
Antiretroviral Use at Study Entry			
None	12.9%	22.9%	$\chi^2 = 12.765$
1+ (no Protease Inhibitor)	10.0%	28.6%	df = 2
1 ≥ (with P.I.)	77.1%	48.6%	$p = .002$**
Antiretroviral Medication Doses Missed in Past 3 Days			
Mean	.099	.096	t = .042
(*SD*)	.207	.240	df = 65
			$p = .967$
Time Since Diagnosis (In Months)			
Mean	91.814	94.314	t = -.301
(*SD*)	(44.590)	(53.243)	df = 138
			$p = .764$
Route of Infection			
Gay/bisexual Sex	47.1%	55.7%	$\chi^2 = 2.939$
Heterosexual Sex	32.9%	34.3%	df = 3
Multiple (inc. IV Drug)	10.0%	5.7%	$p = .401$
Other/Unknown	10.0%	4.3%	
Number of Past STDs			
Mean	1.257	1.014	t = 1.223
(*SD*)	(1.188)	(1.161)	df = 138
			$p = .223$
Average # of Hours Sleep/Night in Past Week			
Mean	7.215	6.941	t = 1.053
(*SD*)	(1.354)	(1.672)	df = 135
			$p = .294$

Table 3 Medical Information Compared Between HLC and MC Groups, Cont'd

	HLC group	MC group	Significance
Past Alcohol Abuse or Dependence			
Present	32.4%	34.3%	$\chi^2(1) = 0.37$
Not Present	67.6%	65.7%	$N = 107$
			$p = .847$
Past Cannabis Abuse or Dependence			
Present	3.4%	19.5%	$\chi^2(1) = 3.912$
Not Present	96.6%	80.5%	$N = 70$
			$p = .048$*
Past Stimulant Abuse or Dependence			
Present	2.8%	6.8%	$\chi^2(1) = .718$
Not Present	97.2%	93.2%	$N = 95$
			$p = .397$
Past Sedative Abuse or Dependence			
Present	.0%	6.7%	$\chi^2(1) = 2.299$
Not Present	100.0	93.3%	$N = 93$
			$p = .129$
Past Cocaine Abuse or Dependence			
Present	15.6%	23.4%	$\chi^2(1) = .713$
Not Present	84.4%	76.6%	$N = 79$
			$p = .398$
Past Hallucinogen Abuse or Dependence			
Present	.0%	3.4%	$\chi^2(1) = 1.212$
Not Present	100.0%	96.6%	$N = 94$
			$p = .271$
Past Opioid Abuse or Dependence			
Present	11.4%	3.3%	$\chi^2(1) = 2.448$
Not Present	88.6%	96.7%	$N = 95$
			$p = .118$

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 4a Means, Standard Deviations, and Significance Tests between the HLC (N = 70) and MC (N= 70) Groups on the MHLOC Subscales

MHLOC Subscale	HLC Mean	(*SD*)	MC Mean	(*SD*)	*t*
Internal (6 items)	23.071	(5.525)	24.943	(5.667)	-1.978*
Chance (6 items)	18.143	(5.981)	17.786	(6.206)	.347
Doctors (3 items)	15.114	(3.019)	14.029	(3.261)	2.044*
Other People (3 items)	9.043	(3.377)	8.786	(3.863)	.419

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 4b Means, Standard Deviations, and Significance Tests between the HLC (N = 70) and MC (N = 70) Group on the MHLOC Subscale Item Averages

MHLOC Subscale	HLC Mean	(*SD*)	MC Mean	(*SD*)	*t*
Internal	3.845	(.921)	4.157	(.944)	-1.978*
Chance	3.024	(.997)	2.964	(1.034)	.347
Doctors	5.038	(1.006)	4.676	(1.087)	2.044*
Other People	3.014	(1.126)	2.929	(1.288)	.419

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 5 MHLOC Subscale Pair-wise Comparisons for the HLC Group

Pair-wise Comparison	*t*	*df*	Significance
Internal – Chance	5.433	69	.000***
Internal – Doctors	-9.153	69	.000**
Internal – Other People	5.581	69	.000***
Chance – Doctors	-13.096	69	.000***
Chance – Other People	.060	69	.952
Doctors – Other People	12.343	69	.000***

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 6 MHLOC Subscale Pair-wise Comparisons for the MC Group

Pair-wise Comparison	*t*	*df*	Significance
Internal – Chance	7.161	69	.000***
Internal – Doctors	-3.466	69	.001**
Internal – Other People	7.249	69	.000***
Chance – Doctors	-9.696	69	.000***
Chance – Other People	.207	69	.836
Doctors – Other People	10.095	69	.000***

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 7 Moderation Analyses

Test of Internal MHLOC as a Moderator of the Relationship between Chance MHLOC and Group Status

Source	*df*	Sum of Squares	Mean Square	*F*	Significance
Model	3	1.142	.381	1.529	.210
Error	136	33.858	.249		

Root *MSE* = .181 R^2 = .033 Adj. R^2 = .011

Variable	Parameter Estimate[a]	Standard Error	*t*	Significance
Intercept	.498	.042	11.796	.0001
Chance MHLOC	.016	.042	.367	.714
Internal MHLOC	-.092	.045	-2.032	.044*
Interaction	.029	.041	.696	.487

Group Status = .498 + .016 *Chance MHLOC* + -.092 *Internal MHLOC* + .029 *Chance* x *Internal MHLOC* + *error*

Test of Doctor MHLOC as a Moderator of the Relationship between Internal MHLOC and Group Status

Source	*df*	Sum of Squares	Mean Square	*F*	Significance
Model	3	2.709	.903	3.803	.012*
Error	136	32.291	.237		

Root *MSE* = .278 R^2 = .077 Adj. R^2 = .057

Variable	Parameter Estimate[a]	Standard Error	*t*	Significance
Intercept	.499	.042	11.798	.0001
Internal MHLOC	-.121	.046	-2.623	.010*
Doctor MHLOC	.109	.040	2.704	.008**
Interaction	.002	.038	.051	.959

Group Status = .499 + -.121 *Internal MHLOC* + .109 *Doctor MHLOC* + .002 *Internal* x *Doctor MHLOC* + *error*

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*$p < .05$; **$p < .01$; ***$p < .001$

[a] Un-standardized coefficients

Table 8 Combinations of Chance and Internal MHLOC Beliefs Compared between HLC and MC Groups

	HLC group	MC group	Significance
High Chance High Internal	25.8%	26.2%	$\chi^2(3) = 3.387$
High Chance Low Internal	19.4%	32.8%	$N = 123$
Low Chance High Internal	27.4%	21.3%	$p = .336$
Low Chance Low Internal	27.4%	19.7%	

*$p < .05$; **$p < .01$; ***$p < .001$

Table 9 Combinations of Internal and Doctor MHLOC Beliefs Compared between HLC and MC Groups

	HLC group	MC group	Significance
High Internal High Doctor	37.7%	36.7%	$\chi^2(3) = 15.535$
High Internal Low Doctor	3.3%	21.7%	$N = 121$
Low Internal High Doctor	29.5%	8.3%	$p = .001$**
Low Internal Low Doctor	29.5%	33.3%	

*$p < .05$; **$p < .01$; ***$p < .001$

Table 10 The Interrelationships (Pearson zero-order Correlations) Between Group Status (HLC vs. MC) and MHLOC Subscales

Variables of Interest	Group Status[a]	Internal MHLOC	Chance MHLOC	Doctors MHLOC	Other People MHLOC
Group Status	1.000				
Internal MHLOC	-.166*	1.000			
Chance MHLOC	.029	.063	1.000		
Doctors MHLOC	.171*	.264**	.102	1.000	
Other People MHLOC	.036	.235**	.238**	.228**	1.000

*$p < .05$; **$p < .01$; ***$p < .001$ (2-tailed)

[a] Group Status: HLC group = 1; MC group = 0

N ranges from 138-140 for all correlations

Table 11 The Interrelationships (Pearson zero-order Correlations) Between Group Status (HLC vs. MC), MHLOC Subscales and Psychosocial Variables Proposed as Mediators

Variables of Interest	Group Status [a]	Internal MHOLC	Chance MHLOC	Doctors MHLOC	Other People MHLOC
Depression (BDI Total)	-.120	.017	.152	-.144	.194*
Depression (BDI affective)	-.190*	.036	.193*	-.185*	.178*
Perceived Stress (PSS)	-.092	-.085	.167	-.183*	.092
Optimism (LOT)[b]	-.045	-.144	.176*	-.313**	.044
Hopelessness (BHS)	-.021	-.193*	.154	-.242**	.038
Avoidant Coping (COPE)	.007	-.121	-.155	.087	-.170*
Adaptive Coping (COPE)	.083	.121	-.216*	.291**	-.055
Self-Efficacy (negative mood)	-.001	.221**	-.204*	.227**	-.226**
Self-Efficacy (action-oriented)	.019	.219**	-.183*	.327**	-.052
Self-Efficacy (AIDS)	.037	.274**	-.103	.222**	-.102

*$p < .05$; **$p < .01$; ***$p < .001$ (2-tailed)

[a] Group Status: HLC group = 1; MC group = 0

[b] higher score on LOT = lower optimism

Table 12 Regression Analyses Testing Affective Depression as a Mediator in the Relationship Between Doctor MHLOC and Group Status (HLC vs. MC)

Source	*df*	Sum of Squares	Mean Square	*F*	Significance
Model	1	1.028	1.028	4.177	.043*
Error	138	33.972	.246		

Root *MSE* = .171 R^2 = .029 Adj. R^2 = .022

Variable	Parameter Estimate[a]	Standard Error	*t*	Significance
Intercept	.106	.197	.535	.593
Doctor	.027	.013	2.044	.043*

Group Status = .106 + .027 *Doctor MHLOC + error*

Source	*df*	Sum of Squares	Mean Square	*F*	Significance
Model	1	125.374	125.374	4.870	.029*
Error	137	3526.970	25.744		

Root *MSE* = .185 R^2 = .034 Adj. R^2 = .027

Variable	Parameter Estimate[a]	Standard Error	*t*	Significance
Intercept	9.390	2.024	4.639	.0001
Depression	-.300	.136	-2.207	.029*

Affective Depression = 9.390 + -.300 *Doctor MHLOC + error*

Source	*df*	Sum of Squares	Mean Square	*F*	Significance
Model	2	1.861	.931	3.848	.024*
Error	136	32.887	.242		

Root *MSE* = .231 R^2 = .054 Adj. R^2 = .040

Variable	Parameter Estimate[a]	Standard Error	*t*	Significance
Intercept	1.731	.211	8.204	.0001
Doctor	.021	.013	-1.582	.116
Depression	- .016	.008	1.946	.054*

Group Status = .269 + .021 *Doctor MHLOC* + -.016 *Affective Depression + error*

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*p = .05; **p <.01; ***p <.001

[a] Un-standardized coefficients

Table 13 Average MHLOC Subscale Means and Standard Deviations for the HLC and MC Groups, and Other Samples of Interest

Form A

	HLC	MC	Diverse HIV-Positive[a]	Healthy Normative[b]
Internal	23.07 (5.53)	24.94 (5.67)	17.46 (4.50)	25.10 (4.9)
Chance	18.14 (5.98)	17.79 (6.21)	10.84 (5.03)	15.6 (5.8)
Powerful Others	-----	-----	17.74 (5.21)	20.0 (5.2)

Form C

	HLC	MC	Breast Cancer Survivors[c]	Chronic Pain[d]
Doctor	15.11 (3.02)	14.03 (3.26)	14.88 (2.60)	11.01 (-----)
Other People	9.04 (3.38)	8.79 (3.86)	8.94 (2.84)	9.19 (-----)

[a] Preau, et al, 2005
[b] Evans, et al, 2000
[c] Naus, et al, 2005
[d] Wallston, et al, 1994

Table 14a Average BDI Affective Subscale Means and Standard Deviations for the HLC and MC Groups, and Other Samples of Interest

HLC	MC	HIV- [a]	HIV+ (pre-AIDS) [b]	HIV+ (AIDS) [c]
4.04 (3.94)	5.99 (5.98)	5.29 (4.74)	11.14 (8.51)	10.52 (7.69)

Table 14b Average BDI Affective Subscale Means and Standard Deviations for the HLC and MC Groups, and Other Samples of Interest

HLC	MC	HIV+ (Asymptomatic) [d]	HIV+ (Symptomatic/AIDS) [e]
4.04 (3.94)	5.99 (5.98)	4.83 (5.67)	6.65 (6.47)

[a] Castellon, et al, 1998
[b] Castellon, et al, 1998
[c] Castellon, et al, 1998
[d] Savard, et al, 1998
[e] Savard, et al, 1999

Appendix A

Multidimensional Health Locus of Control: Form C

Instructions: Each item below is a belief statement about your medical condition with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you agree or disagree with that statement. The more you agree with a statement, the higher will be the number you circle. The more you disagree with a statement, the lower will be the number you circle. Please make sure that you answer **EVERY ITEM** and that you circle **ONLY ONE** number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

1=STRONGLY DISAGREE **(SD)** 2=MODERATELY DISAGREE **(MD)** 3=SLIGHTLY DISAGREE **(D)**	4=SLIGHTLY AGREE **(A)** 5=MODERATELY AGREE **(MA)** 6=STRONGLY AGREE **(SA)**

		SD	MD	D	A	MA	SA
1	If my condition worsens, it is my own behavior which determines how soon I will feel better again.	1	2	3	4	5	6
2	As to my condition, what will be will be.	1	2	3	4	5	6
3	If I see my doctor regularly, I am less likely to have problems with my condition.	1	2	3	4	5	6
4	Most things that affect my condition happen to me by chance.	1	2	3	4	5	6
5	Whenever my condition worsens, I should consult a medically trained professional.	1	2	3	4	5	6
6	I am directly responsible for my condition getting better or worse.	1	2	3	4	5	6
7	Other people play a big role in whether my condition improves, stays the same, or gets worse.	1	2	3	4	5	6
8	Whatever goes wrong with my condition is my own fault.	1	2	3	4	5	6
9	Luck plays a big part in determining how my condition improves.	1	2	3	4	5	6
10	In order for my condition to improve, it is up to other people to see that the right things happen.	1	2	3	4	5	6
11	Whatever improvement occurs with my condition is largely a matter of good fortune.	1	2	3	4	5	6
12	The main thing which affects my condition is what I myself do.	1	2	3	4	5	6
13	I deserve the credit when my condition improves and the blame when it gets worse.	1	2	3	4	5	6

14	Following doctor's orders to the letter is the best way to keep my condition from getting any worse.	1	2	3	4	5	6
15	If my condition worsens, it's a matter of fate.	1	2	3	4	5	6
16	If I am lucky, my condition will get better.	1	2	3	4	5	6
17	If my condition takes a turn for the worse, it is because I have not been taking proper care of myself.	1	2	3	4	5	6
18	The type of help I receive from other people determines how soon my condition improves.	1	2	3	4	5	6

Appendix B

SCORING INSTRUCTIONS FOR THE MHLC SCALES: FORM C

SUBSCALE	POSSIBLE RANGE	ITEMS
Internal	6 - 36	1, 6, 8, 12, 13, 17
Chance	6 - 36	2, 4, 9, 11, 15, 16
Doctors	3 - 18	3, 5, 14
Other People	3 - 18	7, 10, 18

The score on each subscale is the sum of the values circled for each item on the subscale (i.e., where 1 = "strongly disagree" and 6 = "strongly agree"). No items need to be reversed before summing. All of the subscales are independent of one another. **There is no such thing as a "total" MHLC**