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BIOBEHAVIORAL MECHANISMS OF EMOTION AND HIV DISEASE: EXPLORING  
POTENTIAL MEDIATORS OF THE RELATION BETWEEN TRAIT POSITIVE AND  
NEGATIVE AFFECT AND HIV HEALTH STATUS

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of  
Philosophy at Virginia Commonwealth University

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## Acknowledgements

I would like to thank my fine committee members, Kirk Warren Brown, Nancy McCain, Sandra Gramling, Scott Vrana, and Christine Schubert. Each member of my committee has contributed greatly not only to the completion of this project, but also to my growth and professional development as a clinician and researcher in the field of Clinical Health Psychology. I would particularly like to thank my chair, Kirk Warren Brown, for being willing to take on this project with me and for his patient teaching and encouragement throughout this process. I would also like to specially thank Nancy McCain and the VCU School of Nursing for immeasurable tangible and intellectual support with this project and for guidance in my development as a researcher. Finally, I would like to thank the National Institute of Mental Health for funding my work on this project and my advanced training in biobehavioral assessment.

I would also like to thank my family Mike, Kay, and Andrew Stewart for their love and support throughout my whole life. I deeply appreciate the unique qualities you have each brought into my life. Mom, you teach me to be compassionate and foster my desire to help others. Dad, you teach me to be curious about the world and encourage me to think critically about how things work. Andrew, you teach me to have a little more fun in life. I love you all so much!

Finally, I would like to thank all of the great friends, old and new, who have been there in good times and bad. To name a few, I thank my lifelong “sisters” Rea, Katie, Tracey, Heather, Leeza, Kim, Erin, and Juli, my VCU classmates Sarah, Jen, Sharon, Melissa, Monique, Tom, Amanda, Karen, Katie, Ann, Karen, Shay, Mike, Daniel, and Ian, my Rush girls Nini, Megan, Erin, Jen, Angie, Michelle, and Louise, and my Richmond girls Anna, Stephanie, Melissa, Beth, Irene, Valerie, Amy, Joanna, Collin, & Jeannette! You are all amazing people and I love you!

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## Abstract

# BIOBEHAVIORAL MECHANISMS OF EMOTION AND HIV DISEASE: EXPLORING POTENTIAL MEDIATORS OF THE RELATION BETWEEN TRAIT POSITIVE AND NEGATIVE AFFECT AND HIV HEALTH STATUS

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of  
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Virginia Commonwealth University, 2010.

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Considerable research supports an association between negative psychosocial functioning and adverse health outcomes. The *biobehavioral model* is well supported and posits that these effects occur via alterations in physiological response and health damaging behaviors. Evidence is accumulating about potential benefits of positive psychosocial functioning; however, less is known about the mechanisms of these effects. The *broaden-and-build model* of positive emotions holds that positive emotions can *undo* the physiological and behavioral restrictions associated with negative emotions and promote resource development. The present correlational study sought to explore whether cortisol, medication adherence,

and health behaviors (smoking, alcohol use, physical activity, and nutrition) mediated relations between trait positive affect and negative affect and health status in persons living with HIV infection. A moderating role of trait positive affect on the relation between negative affect and mediating variables was also hypothesized, yet an unexpectedly high correlation between trait positive and negative affect precluded the evaluation of this hypothesis. HIV-infected participants (N = 53) collected salivary cortisol five times over the course of one day at home and completed interview the following day. Clinical staff provided HIV symptom ratings, and virologic and immunologic indicators were collected by chart review. Results showed that high trait positive affect was associated with lower total cortisol concentration, and total cortisol mediated the relation between trait positive affect and CD4+ percent. High trait negative affect was associated with poorer medication adherence, and percent adherence mediated the relation between trait negative affect and CD4+ percent and viral load. Mediation hypotheses for health behaviors were not confirmed. Trait positive affect was, however, associated with decreased alcohol intake, increased physical activity, and better nutrition habits. Because this study used cross-sectional design, causation cannot be determined. However, findings provide preliminary evidence on mechanisms by which trait positive affect could be related to HIV disease markers, and findings support existing evidence on mechanisms of trait negative affect in HIV disease. Results also support use of the biobehavioral model and the broaden-and-build model of positive emotions as theoretical frameworks in studying the relation between psychosocial functioning and health outcomes in persons with HIV.

## Biobehavioral Mechanisms of Emotion and HIV Disease: Exploring Potential Mediators of the Relation Between Trait Positive and Negative Affect and HIV Health Status

Over 18,000 persons died from HIV disease in the U.S. in 2003, and over 1 million were living with the disease. The introduction of highly active anti-retroviral treatments (HAART) in 1996 has dramatically reduced the rate at which persons with HIV disease progress to AIDS, resulting in longer life and better quality of life (CDC, 2004). In fact, these medications have changed the nature of HIV disease such that it has come to be considered a chronic, rather than terminal illness, and patients with HIV disease are living long enough that they are increasingly dying from non HIV-related illnesses (Krentz, Kliwer, & Gil, 2005). Thus, comprehensive care for a patient with HIV disease focuses not only on HIV disease management but also on lifestyle factors intended to promote general health and to enhance quality of life.

A number of aspects of psychosocial functioning, including mood disorders, trait affect, and dispositional coping and cognitive styles have been shown to impact morbidity and mortality in both healthy and chronic illness populations (e.g., Barger & Sydemann, 2005, Danner, Snowden, & Friesen, 2001, Leserman, Petitto, Gu, Gaynes, Barroso, & Golden, 2002; Moskowitz, 2003). Existing research has focused primarily on the negative side of psychosocial adjustment, and more recent attention has turned towards studying potential benefits of positive psychological functioning. A number of studies have focused on the benefits of positive dispositional factors such as optimism, benefit finding, and mindfulness; however, fewer studies have focused specifically on trait emotional experience. The current study sought to utilize theory specific to biological and behavioral mechanisms

of positive emotions in exploring the relation between the tendency to experience positive and negative emotions over time, neuroendocrine responding, health promoting behaviors, and health status in persons living with HIV disease.

Two theoretical models will be employed in the current study. The *biobehavioral model* holds that psychological factors generally impact health through biological mechanisms (e.g. neuroendocrine, cardiovascular, and immune changes) and behavioral mechanisms (e.g. adherence to medical recommendations, substance use, diet, smoking, and physical activity levels) (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Williams, Barefoot, & Schneiderman., 2003). This model has been well-supported in describing mechanisms of negative psychosocial functioning in that depression, anxiety, and hostility have each been linked to alterations in either neuroendocrine, cardiovascular, or immune responding (Fredrickson, Mancuso, Branigan, & Tugade, 2000; Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005; Suarez, Kuhn, Schanberg, Williams, & Zimmerman, 1998; Van Eck, Berkhof, Nicolson, Sulon, 1996) and depression is linked to poorer health behaviors (Kobau, Safran, Zarck, Moriarty, & Chapman, 2004; Yarcheski, Mahon, Yarcheski, & Cannella, 2004) and poorer adherence to medical recommendations (DiMatteo, Lepper, & Croghan, 2000). Far fewer studies have examined potential mechanisms of positive psychosocial functioning. Fredrickson's *broaden-and-build model* specifically posits that positive emotions have the potential to promote positive changes in these biological and behavioral mechanisms in that positive emotions *undo* the restrictions associated with negative emotions. This undoing involves a reduction in physiological arousal and a broadening of one's attention, thinking, and behavioral repertoires. Further, the broaden-and-build theory holds that positive emotions enhance the development of physical, social, psychological, and

intellectual resources, which contribute to an increased experience of positive emotions and further resource development in what Fredrickson calls the *upward spiral* of positive emotions (Fredrickson, 2000).

Taken together, these two theories provide a framework for exploring the potential benefits of frequent experience of positive emotions in persons living with HIV disease. Specifically, positive emotions may be associated with enhancements of physical functioning (e.g. healthier neuroendocrine functioning) and with positive health behavior profiles (e.g. greater physical activity, better medication adherence, healthier eating habits, and lower rates of substance use, smoking, and risky sexual behavior) that may over time lead to better health outcomes if they occur on a frequent basis. The primary goal of the current study was to clarify the relation between trait experience of positive and negative emotions and health in persons with HIV disease and to evaluate whether positive emotions might relate to health via similar mechanisms as negative emotions. This study also sought to establish whether positive emotions relate to neuroendocrine responding, health behavior, and health status independent of negative emotions or by buffering the deleterious effects of negative emotions. Because the impact of emotions on health in persons with chronic illness is likely to be a result of chronic rather than momentary behavioral practices and neuroendocrine processes (Herbert & Cohen, 1993, Pressman & Cohen 2005), the current study will focus on the effects of trait, rather than state, emotions. Although clinical distinctions between the terms affect and emotion are well-defined, these terms are used inconsistently in the research literature, thus, they will be used interchangeably throughout this paper.

### **The Biobehavioral Model**

In 1975, Rosenman, Brand, Jenkins, Friedman, Straus, and Wurm published a landmark study in the *Journal of the American Medical Association* linking Type A behavior pattern (time urgency, hostility, and achievement orientation) to increased incidence of coronary heart disease (CHD) during an 8.5 year follow up period. In another pivotal study using a sample of 99 generally healthy men, Peterson, Seligman, and Vaillant (1988) showed that explanatory style during early adulthood (age 25) predicted health outcomes during middle age (ages 45-60), even after controlling for baseline physical and mental health. Men with a pessimistic explanatory style began to experience significantly greater health problems at age 45 compared to more optimistic individuals. These studies helped set the stage for deeper investigation into the specific psychosocial factors that relate to adverse health outcomes and the biological and behavioral mechanisms by which these effects occur.

**Negative psychosocial functioning impacts health.** In addition to the effects of hostility and pessimism described above, wide ranging aspects of negative psychosocial functioning have been linked to adverse health outcomes. For example, depression increases risk of onset of coronary heart disease (CHD; Wuslin & Singal, 2003) and predicts morbidity and mortality among patients with existing CHD (Barefoot & Schroll, 1996). Depression is an independent risk factor for type 2 diabetes mellitus (Eaton, Armenian, Gallo, Pratt, & Ford, 1996), and although the role of depression in onset of cancer is of marginal significance (McGee, Williams, & Elwood, 1994), persons with a lifetime history of depression have been shown to have a 2.6 times greater risk of dying of cancer than persons without a history of depression (Stommel, Given & Given, 2002). Anxiety is an independent risk factor for all-cause mortality in both men and women (Eaker, Sullivan, Kelly-Hayes, D'Agostin, & Benjamin, 2005), increases chances of developing CHD (Barger & Sydeman,

2005), and increases risk of death and recurrent ischemic events following acute coronary events (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). Thus, negative psychological dispositions and clinical syndromes associated with frequent negative emotions appear to negatively impact health in specific populations, and health psychologists have investigated both biological and behavioral mechanisms to help explain these relations.

**Negative psychosocial functioning impacts biological mechanisms.** Negative emotions stimulate activation of the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenocortical (HPA) axes. Activation of the SNS causes increases in heart rate, blood pressure, and respiration, as well as increased blood flow to muscles. Activation of the HPA axis stimulates the release of corticosteroids such as cortisol, which serve to increase blood glucose to provide energy and to suppress antibody production, thereby mediating inflammation. These two systems developed through adaptation and serve the function of optimizing response to a threatening situation (Friedman, 2002). It is adaptive for these responses to occur in order to effectively respond to survival demands of the environment; however, when they occur on a chronic basis, these responses can over time result in adverse health outcomes. For example, cortisol suppression of antibody production may represent a useful diversion of resources towards immediate rather than long-term survival in the context of an acute stressor; however, with chronic HPA stimulation, resistance to infection may be compromised (Friedman 2002). Thus, while momentary emotional experiences elicit immediate physiological responses, it is likely that the chronicity of these emotional experiences will be the determining factor in whether emotions will demonstrate an impact on health outcomes (Herbert & Cohen, 1993). Elevated cortisol levels have been associated with measures of depression and trait anxiety (Van Eck et al.,

1996); however, the relation between cortisol and depression is complicated. For example, cortisol levels can remain elevated in some individuals well past the remission of depressive symptoms (Cowen, 2010). These individuals often are at higher risk of recurrence of depressive symptoms. Elevated cortisol levels have also been identified in people with no personal history of depression but who are at elevated risk of depression due to family history or high neuroticism scores. These findings suggest that a cyclical relation between cortisol and depression exists, such that cortisol hypersecretion, which may be at least partly genetically determined, elevates risk of depression and that depressive episodes are associated with increased secretion of cortisol; this may or may not remit along with depressive symptoms. The current study contributes to a segment of the research literature that focuses on the portion of this cycle whereby psychological functioning influences health via neuroendocrine and behavioral responding; however, it is important to recognize that this is not a simple unidirectional relation.

There is evidence that this pattern of physiological arousal associated with negative psychological functioning may partially explain the observed effects on health outcomes. For example, the effects of the Type A behavior pattern on coronary heart disease were found to be most closely explained by the component of hostility (Williams et al., 1980), and this has been related to increased magnitude and duration of physiological responses (blood pressure, heart rate, and cortisol secretion) to experimentally induced stressors (Fredrickson et al., 2000; Suarez et al., 1998). The relation between depression and CHD may be due to increased physiological risk factors (vascular pathology, ventricular tachycardia, and decreased heart rate variability) associated with depression (Evans et al, 2005). Depression exacerbates complications of diabetes through poor glycemic control and increased insulin



resistance, which may be a result of increased serum glucocorticoids (Evans et al., 2005), and the relation between cancer mortality and depression may be mediated by the immunosuppressive effects of depression (Spiegel & Giese-Davis, 2003).

While most studies have focused on the momentary (state) relation between negative affect and cortisol, a few studies have examined the relation between trait negative affect and total cortisol concentration. Elevated cortisol levels have been associated with high trait negative affect in one study (Polk, et al., 2005) but not in another (Hanson, Maas, Meijman, & Godaert, 2000). The inconsistency between these two studies may be explained by the use of different conceptualizations and measurements of emotion. Polk et al. (2005) assessed trait positive and negative emotions using an adjective rating scale (Usala & Hertzog, 1989) three times per week over the course of two weeks. Positive adjectives included *lively, full-of-pep, energetic, happy, pleased, cheerful, at ease, calm, and relaxed*. Negative adjectives included *sad, depressed, unhappy, on edge, nervous, tense, hostile, resentful, and angry*. Trait positive and negative affect were calculated by summing results across the six measurements over the two week period. Hanson et al. (2000) developed an index of trait negative affect using items from a Dutch translation of the Well-being Questionnaire (Bradley & Lewis, 1990) which were originally designed to assess symptoms of anxiety and depression in persons with diabetes. Participants were asked to rate how often each statement described how they felt during the past few weeks on a 4-point Likert scale from *not at all* to *all the time*. Sample statements included “I have crying spells or feel like it” and “I feel nervous or anxious” (Hanson et al., 2000). These reported inconsistencies in the relation between trait negative affect and cortisol responding may be a result of inconsistencies in defining and measuring trait negative affect and a consensus has not yet

been reached about the best method for measuring trait negative affect in studies of diurnal cortisol.

**Negative psychosocial functioning impacts behavioral mechanisms.** In a sample of 166,564 community participants, increasing numbers of “sad, blue, or depressed” days per month were related to smoking, extremely high and low body mass index (BMI), higher rates of binge drinking, and lower rates of physical activity (Kobau et al., 2004). Meta-analyses have shown that depression increases risk of non-adherence with medical treatment (DiMatteo, Lepper, & Croghan, 2000) and decreases the likelihood of engaging in such positive health practices as physical activity and relaxation (Yarcheski, Mahon, Yarcheski, & Cannella, 2004). Persons who are depressed have double the smoking rates of non-depressed controls and are less likely to quit smoking (Brandon, 1994). Hostility in healthy adults aged 18-30 and pessimistic explanatory style in college students have also been linked to poorer health behaviors, including increased rates of smoking cigarettes and marijuana, increased caloric intake, and greater alcohol consumption (Peterson, 1988; Scherwitz, Perkins, Chesrtey, Hughes, Sidney, & Manolio, 1992). Thus, negative emotions appear to be associated with unhealthy behaviors in some cases.

### **The Broaden-and-Build Model of Positive Emotions**

Negative emotions are ancestrally linked to potentially threatening situations that elicit distinct drives for survival. These drives result in the diversion of cognitive and physical resources toward preparing to react to the threat situation. This then results in restricted physiological and psychological responding in ways that can be harmful to health. Because positive emotions are not related to imminent threat, they do not require a prescribed immediate call to action, as do negative emotions, and thus positive emotions can result in

greater flexibility of physiological and behavioral response (Fredrickson, 2000). Studies have demonstrated that both state and trait positive emotions have the potential to impact biological mechanisms by undoing the effects of negative emotions. For example, after watching a frightening film, participants who were shown videos of puppies or waves crashing on a beach showed faster return of heart rate to baseline than those who were shown either sad or abstract films following the frightening film. This supports the role of state positive affect in undoing the effects of state negative affect. In the same study, a faster recovery was also noted for participants who smiled spontaneously during the frightening film, suggesting a possible protective role of trait positive affect in the presence of state negative affect (Fredrickson & Levenson, 1998). The cumulative effect over time of improved cardiovascular recovery experienced by those high in trait positive affect could translate into lower risk of cardiovascular disease due to decreased strain on the heart (Kok, Catalino, & Fredrickson, 2008).

While negative emotions are typically associated with avoidance behavior, positive emotions are associated with approach behaviors (Fazio, Eiser, & Shook, 2004). Positive emotions are also associated with greater creativity, cognitive flexibility, openness to new information, and enhanced problem solving skills that could impact behavioral responding. Isen, Daubman, and Nowicki (1987) believe that people undergo a cognitive reorganization when they are experiencing positive affect such that it is easier for them to generate unique and new associations that allow for greater generation of ideas for problem solving. In a problem solving study involving a matchbox, a thumbtack, a corkboard, and a candle, 75% of participants who watched a brief positive mood inducing video prior to the task generated the correct solution. Only 20% of participants in the neutral film condition and 13% in the

negative film condition correctly solved the problem (Isen et al., 1987). Fredrickson (2000) describes this expanded and open psychological state as a broadened momentary thought-action repertoire, which enlarges a person's cognitive-behavioral context in ways that lead to the development of lasting physiological, psychological, intellectual, and social resources. Over time, these enhancements in personal resources lead to increases in positive emotions which lead to further resource development and so forth, in what Fredrickson calls the *upward spiral* of positive emotions. In support of the upward spiral hypothesis, prospective studies have demonstrated that positive emotions predict positive coping which in turn predict future positive emotions (Burns, Brown, Sachs-Ericsson, Plant, Curtis, Fredrickson, & Joiner, 2008; Fredrickson & Joiner, 2002). In their prospective analysis examining the upward spiral of coping and social resources, Burns et al. (2008) found that both interpersonal trust and positive coping (defined as "approach" coping as opposed to "avoidance/resignation coping") partially mediated enhancements in positive emotions over time and that positive emotions partially mediated enhancements in interpersonal trust and positive coping over time.

These positive emotion-associated enhancements in problem solving, interpersonal trust, and approach based coping skills could include skill development in the domain of health promoting behavior. Ingledew and McDonagh (1998) found that health behaviors such as exercise and self-care can serve coping functions. It is possible that the development of coping resources in this upward spiral will include using positive health behaviors, particularly for individuals with medical conditions who may choose to use healthy behaviors as an approach based coping response to their concerns for their physical well-being.

In summary, the broaden-and-build model of positive emotions puts forth two types of effects of positive emotions. The upward spiral theory suggests that enhancements in physical, social, intellectual and psychological functioning serve as potential mediators of the relation between trait positive affect and health. The undoing theory proposes that positive emotions exert their effects by reducing physiological and psychological restrictions associated with negative emotions. This study sought to examine hypotheses consistent with both the upward spiral and undoing theories of positive emotions.

**Positive psychosocial functioning impacts health.** Emerging evidence suggests an association between positive psychological functioning and reduced morbidity and mortality in both healthy and specific illness populations, although inconsistencies have been reported in studies of cancer mortality. In a study of 180 Catholic nuns, positive emotional content in autobiographical statements collected at around age 22 predicted survival at ages 75-99. Nuns whose positive affect scores were in the lowest quartile were 2.5 times more likely to have died at follow-up than those whose scores were in the highest quartile (Danner, Snowden, & Friesen, 2001). Life satisfaction was found to predict mortality among men, but not women, over a 20-year follow-up period in a Finnish sample of 18-64 year olds. Specifically, men with low life satisfaction in the sample were at higher risk of disease mortality, and this effect was especially pronounced among men who reported heavy levels of alcohol use at baseline, suggesting a possible mediating role of adverse health behavior (Koivumaa-Honkanen, Honkanen, Viinamaki, Heikkila, Kaprio, & Koskenvuo, 2000). Notable exceptions to the literature on mortality and positive affect include two studies that demonstrated an association between positive affect and shorter survival in persons with metastatic breast cancer (Derogatis, Abeloff, & Melisaratos, 1979) and early stage melanoma

(Brown, Butow, Culjak, Coates, & Dunn, 2000). However, a recent meta-analysis including 70 studies on positive affect and positive psychological traits demonstrated that trait positive affect was associated with reduced all-cause mortality in healthy populations (Chida & Steptoe, 2008). Further, positive psychological traits (such as optimism and hopefulness) were associated with reduced mortality in patients with renal disease and HIV disease. The analyses in this meta-analysis took publication bias and potential behavioral correlates of positive emotions into account.

Morbidity studies have also shown relations between positive emotions and reduced illness across diverse medical conditions. Trait positive emotions, or sometimes called “positive emotionality,” has been associated with decreased prospective risk of stroke (Ostir, Markides, Peek, & Goodwin 2001), reduced rates of all-cause rehospitalization for patients with cardiovascular disease (Middleton & Byrd, 1996), and reduced risk of developing cold symptoms following exposure to cold virus (Cohen, Doyle, Turner, Alper, & Skoner, 2003). Thus, although positive affect has demonstrated some conflicting findings in cancer populations, positive affect and positive psychological functioning appear to be associated with reduced mortality and morbidity in healthy and specific chronic illness populations.

**Positive psychosocial functioning impacts biological mechanisms.** Although experimental manipulations of positive emotion often fail to show a consistent relation between state positive emotions and momentary cortisol response, when measured over a more lengthy time period, the tendency to experience positive emotions appears related to lower levels of cortisol in healthy individuals (Pressman & Cohen, 2005). For example, in a sample of 216 London civil servants (Steptoe, Wardle, & Marmot, 2005), ratings of happiness measured over a two day period was related to lower cortisol levels such that the

happiest quintile showed a 32.1% lower cortisol level compared to the least-happy quintile. This effect was independent of psychological distress, and a similar effect was found in this sample for ambulatory heart rate. Further, compared to the least-happy quintile, the happiest quintile in this sample experienced a significantly lower increase of fibrinogen (a coagulant protein) in response to an induced stress task. A follow-up study with this sample (Steptoe & Wardle 2005) revealed that the association between positive emotions, cortisol, and heart rate was maintained over a period of 3 years. This 3-year follow-up also revealed an additional health benefit of happiness such that systolic blood pressure was lower among the happiest participants. Thus, trait positive emotions may be associated with reduced cortisol secretion and other reductions in physiological arousal.

**Positive psychosocial functioning impacts behavioral mechanisms.** If it is true that positive emotions contribute to the development of positive health behavior practices as part of the development of coping resources, one might expect to find a relation between a person's tendency to experience positive emotions and to practice good health behaviors. Only one published study located has explicitly examined the relation between the tendency to experience positive emotions and health behaviors. Cohen et al. (2003) found that positive emotional style was associated with better sleep quality, better sleep efficiency, increased dietary zinc intake, and increased physical activity levels. Zinc deficiency is associated with impairments in neuropsychological functioning and reduced immunity (Maret & Sandstead, 2006). A recent meta-analysis also demonstrated that hope and positive self-esteem were related to a measure of "general health practices" defined by physical activity and relaxation (Yarcheski, Mahon, Yarcheski, & Cannella, 2004). Feeling good about oneself may enhance interest in protecting health and increase confidence to take action towards this goal. Self-

affirmation through recall of acts of kindness has been shown to increase attention to health-relevant information and subsequent ratings of personal control over changing behavior (Reed, 1998). Thus, positive psychological well-being may be associated with better health practices, although more studies are needed to confirm this relation, and research is needed to address the specific role of positive emotions in facilitating positive health behaviors.

### **The Relation Between Positive and Negative Emotions**

Intuitively, one might expect positive and negative emotions to be inversely related, such that as positive emotions increase, negative emotions decrease and vice versa. Empirically determining the relation between positive and negative emotions has proven to be complicated. Initial studies focused on trait emotions asked participants to simply indicate if they had experienced certain emotions during the last few weeks. Bradburn (1969; Bradburn & Caplovitz, 1965) found that subscales of positive and negative emotions were weakly correlated with one another, interitem correlations within subscales were high, and positive and negative emotion subscales correlated differently with criterion variables. This suggested that positive and negative emotions are relatively independent of one another. However in a series of survey and experience-sampling studies, Diener and Emmons (1984) found that the relation between positive and negative emotions depends on the time frame measured, such that positive and negative emotions are inversely related when measuring momentary (state) emotional experiences and are only weakly related when measuring longer time frames (trait emotional experiences). This means that a person's momentary experience of positive emotions reduces his/her likelihood of experiencing negative emotions in that same moment (and vice versa), but the tendency to experience positive emotions over a



longer time frame (weeks to a year) is nearly unrelated to their tendency to experience negative emotions during that same time frame (Diener & Emmons, 1984).

A number of additional considerations impact the observed relation between positive and negative emotions. For example, the magnitude of the inverse relation between positive and negative emotions is stronger when frequency rather than degree of emotional experience is measured (Watson, Clark, & Tellegen, 1988). Semantic construction of emotion measures can also contribute to the degree of independence between positive and negative emotions. For example, happiness and sadness are semantically opposite emotional states. In contrast, the terms “nervous” and “excited” also represent positive and negative emotional states, but they are not semantic opposites. Therefore, a researcher can achieve independence or bipolarity of positive and negative emotions by selecting the terms to use in a given measure of emotion (Barrett & Russell, 1999). According to Barrett and Russell (1999), emotions inhabit a two-dimensional space defined on one dimension as degree of pleasantness (versus unpleasantness) and on the other dimension as degree of activation (arousal and energy). In their theoretical model, happiness (moderate activation, pleasant) and sadness (moderate activation, unpleasant) appear directly opposite one another, whereas nervousness (high activation, unpleasant) and excitement (high activation, pleasant) appear on the same side of the activation dimension of the affective space. Thus, the degree of independence of positive and negative emotions depends on the combination of items used in a scale to define these constructs.

In developing the Positive Affect Negative Affect Schedule (PANAS), Watson et al. (1988) sought to develop a scale with independence of positive and negative emotions. They selected items that on factor analysis showed high loadings for one factor and near-zero

loadings on the other factor. As a result of this process, the PANAS includes items that are all high on activation. Thus the positive and negative emotions assessed by the PANAS (e.g. excited, distressed) are only slightly negatively correlated with one another. The instructions for the PANAS vary across versions in terms of the time frame for which the participant is requested to make their ratings, ranging from *right now, that is in the present moment* to *in general, that is on the average*. Positive and negative emotions are most strongly correlated when the *during the past year* instructions are used ( $r = -.23$ ) and are least correlated when the *today* instructions are used ( $r = -.12$ ). The current study used the *in the past few weeks* instructions, for which positive and negative emotions have been shown to correlate at  $r = -.22$  (Watson et al., 1988). This means that the PANAS is a desirable measurement tool in the current proposal as the relative independence of positive and negative emotions allows for exploration of a moderating hypothesis - specifically that the presence of trait positive emotions will “buffer” against the effects of trait negative emotions on health outcomes in a way that is consistent with Fredrickson’s undoing theory.

## **Summary**

The biobehavioral model is based primarily on studies of negative psychosocial functioning and suggests that psychosocial factors influence health through both biological and behavioral mechanisms. The broaden-and-build model supports the possibility that positive emotions impact health by undoing the ancestrally rooted biological and behavioral restrictions associated with negative emotions, and will foster the development of physical, social, psychological, and intellectual resources. Negative psychological functioning has been linked to increased mortality and morbidity and impacts biological systems through activation of the SNS and the HPA axes. This pattern of activation triggers neuroendocrine,

cardiovascular, and immune changes that can be deleterious to health over time. Negative emotions are also related to negative health behavior patterns in healthy adults. Conversely, positive emotions, and dispositions associated with positive psychological functioning, have been found to relate to greater survival in Catholic nuns and Finnish men and to reduced morbidity with regard to lifetime risk of stroke, risk of rehospitalization in those with cardiovascular disease, and risk of developing cold symptoms upon viral exposure. Conflicting results have been noted in studies of positive emotions and cancer mortality studies. Trait positive emotions have also been linked to reduced cortisol in healthy adults. Positive emotional style has been found to relate to better sleep, increased zinc intake, and greater physical activity levels. The current study seeks to clarify the relation between trait positive affect and health in persons living with HIV disease and seeks to determine if positive emotions relate to health via similar mechanisms as do negative emotions.

### **Applying the Biobehavioral and Broaden-and-Build Models to HIV Disease**

Managing HIV disease requires an understanding of how the virus impacts its host. As a retrovirus, HIV inserts itself into a cell and is incorporated into the host cell's genetic material (DNA). As the virus replicates, it causes a number of problematic changes in bodily systems. The most damaging of these changes is that the virus compromises the immune system, primarily by destroying CD4+ T-lymphocyte cells (USDHHS, 2004). Central to the coordination of the immune system, CD4+ cells direct other immune cells to carry out their specific functions. As CD4+ cell counts decrease, the immune system becomes increasingly impaired (CDC, 1992). This increasing immune dysfunction is associated with numerous symptoms such as decreased energy, increased pain, and insomnia (Solano, Gomes, & Higginson, 2006), as well as vulnerability to infection and increased mortality (CDC, 1992).

According to guidelines developed by the Centers for Disease Control and Prevention (CDC), people are diagnosed with AIDS when they develop any AIDS-defining illnesses (such as *pneumocystis carinii* pneumonia) and/or their CD4+ count is below 200 cells/ $\mu$ L (CDC, 1993). As a supplement to CDC staging criteria, viral load (the number of detectable copies of the virus in peripheral blood) is used as an indicator of disease severity and effectiveness of medication regimens (Samet et al., 2003). CD4+ lymphocyte percent and CD4+/CD8+ ratios also serve as indicators of immunological status. Of the immune markers, CD4+ percent may be the best indicator because it has less measurement error and may provide better prognostic value in estimating disease progression than the more traditional CD4+ total cell count (Zeller, McCain, & Swanson, 1996). Thus, as HIV disease progresses, people are at greater risk of adverse health outcomes.

**Cortisol and HIV disease.** Cortisol is a glucocorticoid hormone that follows a diurnal circadian cycle characterized by a morning rise reaching peak levels approximately 30-45 minutes after waking followed by a continual decline throughout the waking hours (Polk et al., 2005). Alterations in both total circulating levels and the circadian pattern of cortisol (e.g. flattened curve, attenuated or exaggerated morning rise, elevated evening levels, etc.) have been associated with poorer psychosocial functioning and health outcomes (Adam & Kumari, 2009). HIV infection is associated with a shift in steroid metabolism, which results in increased cortisol levels as well as decreased dehydroepiandrosterone (DHEA) (Clerici et al., 2000). Persons with HIV disease at any stage may show elevated mean cortisol levels compared to the normal population, and cortisol levels have been shown to have an inverse relation with CD4+ counts (Christeff et al., 1997). In a study of 82 asymptomatic HIV-infected men, a 5  $\mu$ g/dl increase of cortisol was associated with double

the risk of developing AIDS (Leserman et al., 2000). In another study with 96 men, a 3 µg/dl increase in average cumulative cortisol was associated with a 40% increased risk of developing AIDS and a 2.6-fold increase in mortality (Leserman et al., 2002). Thus, cortisol levels may be related to health status in HIV disease. However it remains uncertain whether cortisol elevations directly impact the course of disease progression or rather reflect the immune dysregulation that occurs as part of this progression.

**Behavioral mechanisms and HIV disease.** Medication adherence is critical to treatment outcome in managing HIV disease. HAART medications exert their effects by suppressing HIV virus replication, and treatment adherence over 95% is required for optimal viral suppression. Patients with 90% or greater medication adherence showed a median of 89 weeks to viral failure compared to 42 weeks for those with 70-90% adherence and 30 weeks for those with <70% adherence (Kitahata et al., 2004).

Health behaviors, including smoking, alcohol/drug use, physical activity level, diet, and sexual risk behavior may impact HIV-related health outcomes, although findings remain equivocal. Persons with HIV disease who smoke are at an increased risk for several HIV-related infections, including hairy leukoplakia and oral candidiasis (Collins et al., 2001). Smoking was associated with more rapid disease progression and higher risk of death in a sample of 395 HIV-infected men (Page-Shafer, Delorenze, Satariano, & Winkelstein, 1996). Among 924 HIV-infected women taking HAART, smokers were less adherent to their medications; however, after controlling for adherence, smokers still had poorer viral responses to their medication (Feldman et al., 2006). *In vitro* lab studies using human macrophage cells have suggested that alcohol may directly compound the immune suppressing effects of HIV (Chen, George, & Sperber, 1998, Wang et al., 2002), and alcohol

abuse has been associated with reduced virologic and immune response to HAART (Miguez Shor-Posner, Morales, Rodriguez, & Burbano, 2003). However, poorer virologic and immune status was not demonstrated in persons living with HIV who were abusing alcohol and not prescribed HAART, suggesting alcohol may exert its effects by interacting with HAART medication (Samet et al., 2003). Drug use (excluding drugs that are smoked) does not appear to impact HIV disease outcomes per se; however, certain drugs may interact with HAART and pose problems with medication efficacy (Des Jarlais, 1999). Physical activity has been related to lower viral load (Bopp et al., 2004), and in a longitudinal sample of 156 HIV-infected men, those who exercised 3-4 times per week were less likely to have progressed to AIDS or to have died from AIDS at both one and two years post-assessment (Mustafa, Macer, Thompson, Jackson, & Selassie, 1999). Risky sexual behavior puts persons with HIV disease at risk for re-infection with a potentially more virulent strain of HIV or other sexually transmitted disease, and such (re-)infection may accelerate the course of the disease (Taylor et al., 1992). Although the impact of these behavioral factors on HIV disease specific outcomes may be minimal, each of these behaviors is listed by the US Department of Health and Human Services as targets to improving health and reducing risk of chronic illness, in accord with *Healthy People 2010* program (USDHHS, 2000). Considering that patients with HIV disease are now living longer and increasingly dying of non HIV-related causes, it is beneficial to persons with HIV disease to engage in healthy behaviors to promote general health.

**Negative psychosocial functioning and health status in HIV disease.** Negative psychological functioning may have a deleterious effect on health outcomes in patients with HIV disease. For example, in a 7-year study of 1,716 HIV-infected women, those who

reported symptoms indicating “probable” depression at 75% or greater of their study visits were more than twice as likely to die of AIDS-related causes than were women with limited or no symptoms (Cook et al., 2004). A 9-year study of 96 HIV-infected men (Leserman et al., 2002) found that progression to AIDS was associated with highly stressful life events, high anger, and depressive symptoms. In that study, an increase of one standard deviation in cumulative anger was associated with a 40% increased risk of developing AIDS (defined as a CD4+ count < 200 µg/dl). A similar increase in depression translated to a 75% increased risk of clinical progression to AIDS (i.e., presence of AIDS-defining illness). In a study of 243 injecting drug users, depression predicted progression to AIDS even after controlling for medication non-adherence (Bouhnik et al., 2005). Accumulating evidence suggests that depression, anger, and stress can impact health outcomes in HIV disease.

**Negative psychosocial functioning and cortisol in HIV disease.** Elevated levels of cortisol have been documented in people at all stages of HIV infection (Christeff et al., 1997). Additionally, cortisol levels in persons with HIV disease have been reported to covary with negative emotional state. For example, elevated cortisol has been found in HIV-infected individuals who were anxious, depressed (Gorman et al., 1991), and bereaved (Goodkin et al., 1996). Cortisol reductions in a group of 30 HIV-infected men in a 10-week relaxation training program were associated with improvements in global mood and reductions in anxiety (Cruess, Antoni, Kumar & Schneiderman, 2000). For 74 HIV-infected men, a 10-week bereavement group resulted in decreased cortisol levels and increased CD4+ count (Goodkin et al., 1998). Thus, cortisol appears related to negative emotional states in persons with HIV disease, suggesting that negative emotions may exert their effects on health partially by stimulating excess release of cortisol.

**Negative psychosocial functioning and health behaviors in HIV disease.** In a multi-site study of 980 HIV-infected individuals, depressive symptoms were found to be the strongest correlate of medication non-adherence (Reynolds et al., 2004). Successful treatment of depression has also resulted in improved medication adherence (Rabkin et al., 1997). There is evidence from other populations that negative emotions influence rates of smoking, alcohol intake, and physical activity. One study showed that depression was associated with greater sexual risk taking behavior and increased recreational drug use in persons with HIV disease (Kelly et al., 1993). Emotional distress was also shown to be associated with decreased readiness to quit smoking in a sample of HIV positive individuals (Burkhalter, Springer, Chabra, Ostroff, & Rapkin, 2005). Hence, negative psychological functioning may impact health outcomes in persons with HIV disease through decreased medication adherence and promotion of poorer general health practices.

**Positive psychosocial functioning and health status in HIV disease.** Positive emotions were associated with decreased rates of mortality in a sample of 407 HIV-infected men (Moskowitz, 2003). Participants who reported higher average rates of positive emotions on the positive affect subscale of the Center for Epidemiological Studies-Depression (CES-D) scale were at a reduced risk for AIDS mortality such that for every 1 point increase in positive affect, risk of death decreased by 14% (Moskowitz, 2003). This study suggests the possibility of a relation between positive emotions and health outcomes in HIV disease, though this hypothesis deserves more careful study. For example, because the CES-D positive affect subscale consists of only 4 items (“I felt that I was just as good as other people,” “I felt hopeful about the future,” “I was happy,” and “I enjoyed life”), use of a more



comprehensive measure of affect, such as the well-validated PANAS, (Watson et al., 1988) may be warranted, and the present study used this more comprehensive measure.

**Positive psychosocial functioning and cortisol in HIV disease.** Positive emotions have demonstrated an inverse relation with cortisol levels in the general population (Steptoe et al., 2005) and this relation has been shown to remain stable across a three year follow-up period (Steptoe & Wardle, 2005). Unfortunately, there is a dearth of evidence regarding the influence of positive emotions on cortisol in persons with HIV disease, as no published studies have directly assessed this relation. This gap in the literature was addressed by the current study.

**Positive psychosocial functioning and health behaviors in HIV disease.** In a study of 2,684 HIV-infected individuals, use of positive coping (e.g., using the situation to grow as a person) predicted increases in physical activity following HIV diagnosis. Both positive coping and emotional well-being (e.g., feeling “calm and peaceful”) predicted positive change in alcohol/drug use following HIV diagnosis (Collins et al., 2001). HIV positive men with an optimistic attitude towards their ability to control progression of their disease demonstrated better health practices (a composite of healthy diet, jogging, adequate sleep, and relaxation) than those with a pessimistic attitude (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). Thus, positive psychological traits may be associated with positive health practices; however, no published studies located have explored the relation between trait positive affect and health behaviors in HIV positive individuals. The present study addressed this knowledge gap.

### **Contribution to Current Literature**

The current study sought to bring a solid theoretical framework to the evaluation of the potential mechanisms that may link trait positive emotions to health outcomes.

Voluminous research shows the deleterious effects of negative emotions and negative psychological functioning in healthy and chronically ill samples, and evidence suggests that these effects occur via biological and behavioral mechanisms. A number of studies have demonstrated beneficial effects of positive psychological functioning in both healthy and chronically ill samples. Other studies have failed to show a relation between positive affect and health outcomes, and positive affect was associated with increased mortality in specific cancer populations.

Whether positive emotions relate to health outcomes in any population remains equivocal, and the potential mechanisms of such effects remain relatively unexplored. The study of positive emotion is progressing, and the field would benefit from additional studies focused on positive emotions. The current study explored theoretically based explanations of the potential benefits of positive emotions. If positive emotions are beneficial to health, it may be that these benefits are occurring via the same biological and behavioral mechanisms as negative emotions, a proposition supported by the broaden-and-build model of positive emotions. An additional question to be explored in this study is whether trait positive emotions exert their effects independently of the effects of negative emotion or by buffering against the deleterious effects of negative emotions. These hypotheses are not mutually exclusive; positive emotions may act both directly and indirectly on health outcomes. The current study sought to answer some of these questions.

Consistent with the upward spiral theory of positive emotion, three potential mechanisms, namely cortisol, medication adherence, and health behaviors were hypothesized

to mediate relations between trait positive affect and health status. In accord with the undoing theory of positive emotions, trait positive affect was hypothesized to moderate the relation between trait negative affect and these hypothesized mediators. The specific hypotheses for this study were as follows:

**Hypothesis 1:** Total cortisol concentration will mediate the relation between trait positive emotions and health status as indicated by CD4+ percent, viral load, HIV symptoms, and self-reported general physical health status. Specifically, high trait positive emotions will be associated with lower total cortisol concentration. Low total cortisol concentrations will in turn be associated with higher CD4+ percent, lower viral load, fewer HIV symptoms, and higher self-reported general health.

**Hypothesis 2:** Health behaviors will mediate the relation between trait positive emotions and health status as indicated by CD4+ percent, viral load, HIV symptoms, and self-reported general physical health status. Specifically, high trait positive emotions will be associated with higher percent medication adherence and lower negative health behavior scores. Higher percent medication adherence will be associated with higher CD4+ percent, lower viral load, lower HIV symptoms, and better self-reported general physical health. Negative health behaviors will be associated with lower CD4+ percent, higher viral load, greater HIV symptoms, and higher self-reported general health.

**Hypothesis 3:** Total cortisol concentration will mediate the relation between trait negative affect and health status indicators. All relations will be in the opposite direction from those stated in hypothesis one.

**Hypothesis 4:** Health behaviors (negative health behavior composite score and percent medication adherence) will mediate the relation between trait negative emotions and health status. All relations will be in the opposite direction from those in hypothesis two.

**Hypothesis 5:** Trait positive emotions will moderate the relation between trait negative emotions, total cortisol concentration, percent medication adherence, and negative health behaviors. Specifically, when higher levels of trait positive affect are present, the association between trait negative affect and each of these three proposed mechanisms will become either non-significant or will be significantly reduced in magnitude.

## **Method**

### **Objective**

The primary purpose of this study was to explore the relation between trait positive and negative emotions and a) health behaviors (including smoking, physical activity, alcohol/drug use, diet, sexual risk, and medication adherence), b) salivary cortisol, and c) health indicators (HIV disease related symptoms, CD4+ percent, viral load, and general physical health), with special emphasis on the relation of positive emotions to these variables.

### **Design**

This study used a between-subjects cross-sectional design. Participants completed a one-time psychosocial interview and provided five saliva samples over the course of one day. Medical care providers in the Virginia Commonwealth University Health Systems Infectious Disease Clinic (VCUHS ID) provided ratings of current HIV disease-specific symptomatology, and virologic and immunologic data were obtained by medical chart

review. Each participant received a \$5 gift card to either Walmart or Target stores (based on participant preference) and two bus tickets as compensation for their time and effort.

### **Sample Size Determination**

Power analyses were conducted for each model to determine the necessary sample size. Expected effect sizes were estimated from previous studies on the effects of negative emotion and positive emotion. The expected effect size for affect and health behaviors was based on a meta analysis for depression and health behaviors (DiMatteo et al., 2000) and was estimated to be  $d = .49$ . The expected effect size for affect and cortisol was  $r = .62$  based on a large population based study of positive affect and cortisol (Steptoe et al., 2005). The expected effect size for affect and health status was  $d = .39$  based on differences in CD4+ cell counts in bereaved and non-bereaved persons living with HIV disease (Goodkin et al., 1996). Based on the lowest power estimate (.39), alpha of .01, and power of .80, it was determined that a sample of 67 would be necessary for the proposed study to possess adequate power to evaluate the primary objectives.

### **Participants**

Seventy HIV-infected individuals were recruited from the VCUHS ID clinic. Fifty-three individuals completed the research interview. Enrollment in the study was discontinued before the target sample size of 67 persons due to a temporary geographic move of the present researcher (to complete a clinical internship). Additional enrollment was considered upon completion of the researcher's return to the study site; however, the validity of comparing data collected one year after the original data was questioned considering the rapidly advancing treatment of HIV disease. Further, preliminary analyses revealed several statistically significant associations among key study variables with a sample of 53 persons,

thus it was determined that the sample of 53 was adequate for evaluating the current hypotheses.

The sample was primarily male (75%) and African American (68%) with the remaining persons describing their primary ethnicity as Caucasian. Four individuals (8%) also reported their ethnicity as “mixed” such that two were both Caucasian and Hispanic, one was both Caucasian and Native American, and one was both African American and Native American. For purposes of statistical analyses, these four individuals were included with either the Caucasian or African American groups. The average participant age was 44 years (SD = 7.8, range = 22-56 years). The current sample therefore reflected a population of primarily urban-dwelling African American individuals, which is possibly a distinct population from many studies in HIV which have more frequently sampled from homosexual populations. This sample may also better represent the national profile of persons living with HIV disease (CDC, 2007). Requirements of participation included being prescribed antiretroviral medications (HAART) at the time of enrollment and being between the ages of 18 and 60. Exclusion criteria included recent (within 30 days) symptoms of uncontrolled psychotic disorder (see Appendix A for psychosis screening questions).

### **Research Setting**

Participants were recruited through the VCUHS ID clinic. This clinic is located in a major urban teaching hospital in Richmond, Virginia. A total of 1,891 HIV-infected patients were seen in the clinic during 2005, the year prior to the beginning of the present data collection. Patient care in this clinic includes multidisciplinary treatment provided by a team of physicians, nurse practitioners, physician’s assistants, nurses, and social workers.

### **Screening and Informed Consent Procedures**

Participants were recruited from the waiting room of the clinic by the researcher, who provided introductory information about the study. Interested participants were screened in a private room in the clinic and were provided a verbal overview of the study, a review of the risks and benefits of participating in the study, and were informed of the rights of study participants. Persons who provided written informed consent (Appendix B) and met inclusion criteria were enrolled in the study. Once enrolled, each participant was scheduled for a psychosocial interview. To reduce participant burden, psychosocial interviews were scheduled for the day of the next medical appointment in the clinic whenever possible. They were provided with salivettes and verbal and written instructions on the saliva collection procedure (Appendix C) to be completed on the day before their next appointment. Saliva collection instructions were to collect saliva five times throughout a single day (upon awakening, 30 minutes after waking, 12 noon, 5 pm, and 9 pm) and to record cortisol-relevant activities that day using a log (see Measures section below). Times for each saliva collection were pre-labeled on the 5 collection tubes.

### **Data Collection Procedure**

Participants received a phone call approximately 48 hours prior to their next appointment. This was done to remind them of their appointment and to review the cortisol collection procedure. On the day of the next appointment (generally three months after initial enrollment), participants submitted their saliva samples and cortisol logs, and completed a 45-minute interview to collect psychosocial data. Data collection appointments were conducted in a private office in the ID clinic. Saliva samples were delivered immediately to the General Clinical Research Center (GCRC) for freezing until cortisol assays were performed on the entire set of all participants' samples. As part of standard care,

the ID clinic collects venous samples at each medical visit to monitor virologic and immunologic status. Virologic and immunologic data based on the blood samples collected on the day of data collection were collected by chart review approximately 2 weeks after the data collection appointment. In several cases, participants did not have their blood sampled on the day of psychosocial data collection. In those cases, virologic and immune data collected within three weeks of the participant's data collection appointment were used. Studies have shown that while CD4+ total count can vary significantly over the course of days or weeks, CD4+ percent remains relatively stable over time and is essentially unchanged when measured over the course of 30 days (Ekouevi et al., 2007). Similarly, viral load measured by viral RNA has been demonstrated to remain "almost identical" (p. 1985, Combs et al., 1993) in repeated measurements up to 60 days even in studies published during the pre-HAART era. Thus, these deviations from scheduled venous sampling can be considered valid indicators of participants' virologic and immunologic status around the time of psychosocial interview.

## **Measures**

**Demographics and cortisol log.** Demographic data were collected using the demographic form (Appendix D). Participants were asked to record activities that may impact cortisol levels on the day they collected saliva samples. The cortisol log (Appendix E) queried about potential covariates of diurnal cortisol secretion including exercise, alcohol and tobacco use, medications taken, current happiness/unhappiness rating, symptoms of illness, hours of sleep the night before saliva collection, time of awakening, and if the (female) participant was currently menstruating or taking oral contraceptives (Adam & Kumari, 2009). The happiness/unhappiness ratings on the cortisol log were measured using



the Emotions Questionnaire (Fordyce, 1988). The Emotions Questionnaire is a brief assessment tool that asks participants to rate their happiness/unhappiness on a 10 point Likert scale from *very unhappy* to *extremely happy* and then to rate the percent of the reference period they have felt *happy*, *unhappy*, and *neutral*. The instructions can be varied to reflect various time frames from “this year” to “today.” On the cortisol log, the instructions asked participants to rate happiness/unhappiness “today.” The two day test-retest reliability of this scale is .98, and the four month test-retest reliability is .67; demonstrating that this is a reliable measure that is also sensitive to change. Validity of this scale is demonstrated by significant positive correlations with other measures of happiness such as the Affectometer-2 ( $r = .71$ ) and significant negative correlations with measures of depression such as the Beck Depression Inventor ( $r = -.54$ ) (Fordyce, 1988).

**Emotion.** Trait positive and negative emotions were measured using an extended version of the PANAS (Tugade & Fredrickson, 2004; Watson et al., 1988; Appendix F). The original scale asks participants to rate how strongly (from 1=*very slightly or not at all* to 5=*extremely*) they have felt each of a list of 20 emotions. Instructions can be varied depending on the desired time frame. For example, participants can be asked to rate how they feel “right now”, “during the past year”, or “in general, that is, on the average.” However, long time frames can introduce retrospective memory biases (Robinson & Clore, 2002) and assessment of trait or chronic emotional state can be assessed reliably with such time frames as the past week or past few weeks. Thus in the current study, participants rated their emotions “during the last few weeks.” Using these instructions, both the positive and negative affect subscales have a demonstrated internal consistency ( $\alpha$ ) of .87 (Watson et al., 1988). Watson et al. (1988) also report a test-retest reliability (over eight weeks) for the

positive affect subscale of  $\alpha = .58$  and for the negative affect subscale of  $\alpha = .48$ . The PANAS also demonstrates good convergent validity, with correlations ranging from .76 to .92 with other brief affect measures (Watson et al., 1988). Eighteen additional items (*amused, angry, anxious, blue, calm, content, curious, depressed, disappointed, discouraged, disgusted, happy, relaxed, relieved, sad, satisfied, surprised, and tired*) that were added to the PANAS by Tugade and Fredrickson (2004) for studies on the broaden-and-build theory of positive emotions were also included here. Principle components factor analysis of this extended version of the PANAS revealed a two factor solution that accounted for 47% of total variance (compared to 30% in the original PANAS) and a coefficient alpha of .90 for the positive affect subscale and .84 for the negative affect scale (Tugade & Fredrickson, 2004). Internal consistency in the current sample was  $\alpha = .92$  for the positive affect subscale and  $\alpha = .91$  for the negative affect scale.

**Behavior.** Medication adherence was measured using the Terry Beirn Community Programs for Clinical Research on AIDS medication adherence scale (TBCPCRA, Form 646, Mannheimer, 2002, Appendix G). This scale assesses percent adherence over the last 7 days along with reasons for missed doses. Participants were asked to list each medication they were prescribed and how many of each pill they were to take each day. When participants were uncertain of the names of their medications, they were shown a chart with photographs of each pill. If the participant remained uncertain of the name of their medication, the medication name was coded as “unknown.” They then rated whether they took *all, most, one half, very few, or none* of their pills in the last seven days for each medication separately. These levels of adherence were coded as 100%, 80%, 50%, 20%, and 0% adherence respectively. Total percent adherence was then calculated by averaging percent adherence

across all medications. Validity of this scale has been demonstrated by association with virologic and immunological outcomes (Mannheimer, 2002). In a large validation study, 100% self-reported adherence using the TBCPCRA was associated with a 12 month 2.77  $\log_{10}$  copies/mL reduction in viral load compared to a 2.33  $\log_{10}$  copies/mL reduction for those reporting 80-99% adherence and a 0.67  $\log_{10}$  copies/mL reduction in those reporting < 79% adherence. CD4+ cell increases of 179, 159, and 53 cells/ $\mu$ L were also associated with these respective levels of reported adherence. Percent adherence was analyzed as a continuous variable in the current study.

Participants were interviewed about their habits regarding diet and physical activity using the Health Promoting Lifestyles Profile II (HPLP II; Appendix H), which is a revision of the HPLP (Walker, Sechrist, and Pender, 1988). The HPLP II is a 52-item scale that asks participants to rate whether they *never*, *sometimes*, *often*, or *routinely* engage in healthy behaviors. The HPLP II generates an overall score as well as subscales for physical activity, nutrition, health responsibility, spiritual growth, stress management, and interpersonal relationships. This six-factor solution was confirmed by factor analysis in both the HPLP and HPLP II (Walker et al., 1988; Walker & Hill-Polerecky, 1996). Convergent validity was demonstrated by  $r = .68$  with the Personal Lifestyle Questionnaire. The scale does not appear to be subject to social desirability biases (Walker & Hill-Polerecky, 1996). The HPLP II total score has demonstrated alpha reliability of .93 and subscale alpha reliabilities range from .75 to .83 (Salyer, Sneed, and Corley, 2001). Alpha reliabilities for the nutrition and physical activity subscales in the current sample were .50 and .76, respectively.

Alcohol use during the past thirty days was assessed using the quantity frequency variability method. This method estimates alcohol intake during a selected reference period

by asking the participant to describe the frequency and quantity of their average alcohol consumption and the frequency and quantity of heavy atypical alcohol consumption. Although no “gold standard” exists in measuring alcohol use, a number of self-report methods are widely used, including diary, quantity frequency (which assess only typical alcohol intake), quantity frequency variability, and weekly recall (Lemmens, Tan, & Knibbe, 1990). The preferred method of estimating validity of alcohol use measures is by calculating the extent to which alcohol intake measured by the tool accounts for alcohol sales, a concept termed *coverage*. Coverage data supports diary methods over all other methods (coverage of 67% compared to 46-58% for other methods); however, the current study design did not allow for diary data collection. A quantity frequency variability approach was selected due to a relatively high reported coverage level of 57% (Lemmens et al., 1990) and because a report from the National Institute on Alcohol Abuse and Alcoholism suggests that accounting for variability in drinking behavior holds the greatest promise for improving coverage (Dawson, 2003). Slight variations in precise wording occur across different quantity frequency variability measures. The current study utilized the questions described by Midanik et al. in their 1998 study (Appendix I), which demonstrated a superior estimation of alcohol intake using quantity frequency variability when compared to a newer method, the timeline follow-back technique. Participants were advised to answer each question using the definition of drink as one 12 ounce can or bottle of beer (or wine cooler), 1 glass of wine, or 1 shot of liquor. Questions included: 1) During the past 30 days, on how many days did you have at least one drink of alcohol? 2) During the past 30 days, how many alcoholic drinks did you usually have in one day on the days that you drank? 3) During the last 30 days, what is the most number of alcoholic drinks you had in one day? 4) Referring to your answer to

question 3, on how many days did you have that most number of drinks during the last 30 days? Midanik et al. (1998) also included closed-ended response categories for responses. This is common in quantity frequency variability formats; however, the current study utilized an open-ended response format in order to obtain continuous data and to facilitate ease of administration (Dawson, 2003). Tobacco use was calculated using a similar algorithm (Appendix J) by multiplying the number of days each participant reported smoking each week by how many cigarettes they reported smoking on average per day. If the participant presented a range for number of cigarettes, the midpoint was used for analyses.

Drug use and sexual risk behavior were assessed using the Risk Behavior Survey (RBS; Appendix K) (University of Washington, 2007). The RBS is a shortened version of the Risk Behavior Assessment (RBA) developed originally as part of a cooperative agreement between the National Institute of Drug Abuse and several grantee organizations in the AIDS Cooperative Agreement program (Community Research Branch, National Institute on Drug Abuse, 1993). The original RBA takes 30-45 minutes to administer and assesses lifetime and recent history of drug and sex risk behavior as well as drug treatment history. The RBA is a modular assessment tool that allows the interviewer to tailor the interview by skipping to questions that are appropriate given the respondent's previous answers. Internal consistency ( $\kappa$ ) of the RBA drug use items based on consistent reporting of drug use in the last 30 days and in the last 48 hours ranged from .82 to 1.0. Test-retest reliability coefficients for reporting of drug use ranged from .69 to .78. Test-retest reliability for sexual risk behaviors ranged from .80 to .83 with the exception of a question regarding number of sexual partners who were injecting drug users ( $r = .66$ ) (Needle et al., 1995).

The RBS includes only sections that are focused on drug use and sexual risk behavior in the last 30 days and requires 6-10 minutes to administer. The RBS drug assessment section includes cocaine, heroin, cocaine and heroin combined, amphetamines, and opiates. For drug use, the interviewer asks participants if they have ever used a particular drug, how often they have used it in the last 30 days, and how often they have injected the drug in the last 30 days. For sex risk, the RBS assesses number of both male and female sexual partners in the past 30 days, frequency of different types of sexual behavior (oral, anal insertive, anal receptive, vaginal insertive, vaginal receptive intercourse) as well as the frequency of using condoms or dental dams for each sex act. Drug use items were open ended and categorical response options were provided for frequency of sexual behaviors (seven options from “once or irregularly” to “four or more times per day”) and what proportion of the time condoms or dental dams were used for each sex act (five options from *never* to *always*) (University of Washington, 2007). Participants in the current study reported little to no use of heroin, amphetamines, or opiates in the past 30 days. Seven participants reported using cocaine in the last 30 days, thus a “used cocaine in the last 30 days” yes/no dichotomous variable was created to analyze drug use behavior. Similarly, two dichotomous (yes/no) variables, namely, multiple partners (of any gender), and any incidence of unprotected intercourse (anal or vaginal), were created that collapsed sex risk behavior across the different categories (cf., Bonhert & Latkin, 2009).

To reduce family-wise error in the statistical analyses of multiple health behaviors, a composite negative health behavior score was created (Tabachnick & Fidell, 2007). Of the eight individual health behaviors (physical activity, nutrition, medication adherence, smoking, alcohol use, cocaine use, multiple partners, and unprotected intercourse) that were

measured in this study, four behaviors were selected based on their moderate to high intercorrelations ( $r = .18$  and above): alcohol use, tobacco use, physical activity level, and nutrition. The scores for each of these four behavioral measures were first converted to  $z$ -scores. Next, physical activity and nutrition were reverse-scored and the negative health behavior composite was calculated as the mean of the four  $z$ -scores. Alpha reliability for this composite scale was .72. Percent adherence was not included in the composite measure due to its low correlation with other health behaviors; however, it was retained for a separate analysis due to a significant correlation with negative affect. Having multiple partners, engaging in unprotected intercourse, and using cocaine in the last 30 days were dropped from the primary analyses to be reported here due to low correlations with affect and health status indicators in preliminary analyses.

**Cortisol.** Salivary cortisol was collected using Salivettes (Sarstedt AG & Co., Numbrecht, Germany), which are small pieces of tubular-shaped cotton that are packaged in a sterile plastic tube. Cortisol follows a diurnal slope, with levels peaking in the morning and decreasing throughout the day. For this reason, it is necessary to measure cortisol throughout the waking hours to assess the diurnal pattern. Cortisol studies often collect saliva multiple times between waking and bedtime hours, and many researchers have included a collection point 30 minutes after waking to capture the circadian peak (Adam & Kumari, 2009). Thus, participants were instructed to collect saliva at five time points over the day by placing the cotton in their mouth sucking or chewing on the cotton for 2 minutes to ensure complete saturation before returning the cotton to the capped plastic tube (Hanson et al., 2000). Participants were instructed to collect saliva immediately upon awakening (prior to smoking, drinking, brushing teeth, or eating), again 30 minutes later, and then again at 12 pm, 5 pm,

and 9 pm. Each salivette tube was pre-labeled with the time that the sample should be collected. Participants received verbal and written instructions at their consent meeting and brought their samples to their research appointment as described in the data collection procedure section above. Once the samples were submitted to the researcher, the interview was completed, and participant incentives had been distributed, each participant was asked to fill out a saliva collection compliance rating sheet and fold it closed while the researcher left the room. Each participant was asked to respond to two statements using a 4-point Likert scale ranging from “All of the time” to “none of the time.” The statements were: 1) for each saliva collection, I collected my saliva at the time I was asked to collect it, 2) for each saliva collection, I kept the cotton in my mouth and sucked or chewed on it for two full minutes each time.

All samples were delivered to the GCRC and frozen upon receipt from each participant. Cortisol levels of cryopreserved saliva specimens were batch-assayed using commercial ELISA kits standardized for salivary samples (Salimetrics, Inc.). Highly qualified personnel of the Core Laboratory of the GCRC performed these assays according to the manufacturer’s specifications. For total cortisol secretion, an area under the curve with respect to ground (AUCg) formula was utilized (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003).

**Health status.** Immunologic measures collected by chart review included CD4+ total cell count, CD4+ percent, and CD4+/CD8+ ratio. CD4+ total cell count and CD4+/CD8+ ratio were collected for general sample reporting; however, CD4+ percent was utilized as the sole indicator of immunologic status due to its superior stability of measurement. Virologic status (viral load) was also determined by chart review.



HIV disease-related symptoms were rated by each participant's care provider following their appointment using the Revised HIV Center Medical Staging System (rHCMSS; Appendix L) (McCain, Lyon, Higginson, Settle, Robins, & Fisher, 1998). The rHCMSS provides an alternative staging system to that of CDC guidelines. While CDC guidelines are clinically useful, they provide only nominal data and do not allow for improvements in disease status because a person's staging by CDC criteria can only progress downward. The rHCMSS is based on CDC criteria for defining AIDS and has the advantage of assessing both presence and severity of AIDS-defining illnesses, as well as providing ordinal scale data that represent a clinically meaningful measure of disease severity (McCain et al., 1998). The rHCMSS is significantly correlated with CDC staging criteria ( $r = .80$ ) and CD4+ percent ( $r = -.62$ ), demonstrating good construct validity. Interrater reliability of the rHCMSS has been reported  $\kappa = .95$  (McCain et al., 1998).

General symptoms were measured using the physical health composite score from the RAND 36-Item Health Survey (RAND-36; Appendix M) (Hays, Sherbourne, and Mazel, 1993). The RAND-36 is a publicly available version of the Medical Outcomes Survey 36-Item Short-Form health survey (SF-36, Ware & Sherbourne, 1992). The RAND 36-Item Health Survey contains the same items as the SF-36, but the RAND-36 uses a slightly different scoring algorithm from the SF-36. The alternative scoring algorithm provides identical results for six of the eight scales and some differences emerge for the pain and general health subscales. The RAND-36 scoring algorithm can result in slightly higher scores on the pain subscale, indicating less pain (mean difference of 3.33 out of possible range of 1 to 100); however, pain scores on the RAND-36 correlate at 0.99 with pain scores on the SF-36 (Hayes, Sherbourne, & Mazel, 1993). RAND-36 produces slightly lower scores on the

general health scale, indicating poorer general health (mean difference of -1.37 out of possible range of 0 to 100); however, these subscales on the two measures also correlate at 0.99 (Hays et al., 1993). In a summary of 15 studies, internal consistency and test-retest reliability of the eight subscales of the SF-36 generally exceeded .70 and most exceeded .80. Concurrent, content, and predictive validity have also been demonstrated in a wide range of studies (Ware & Gandek, 1998). The RAND-36 measures eight health domains: 1) physical functioning, 2) role limitations due to physical health problems, 3) bodily pain, 4) social functioning, 5) general emotional well-being, 6) role limitations due to emotional problems, 7) vitality (energy/fatigue), and 8) general health perceptions. Higher scores on each scale represent better functioning in that domain. For example, a high pain score indicates minimal problems related to pain. The eight subscales can also be combined to create a composite physical health score (physical functioning, role limitations due to physical health, bodily pain, and general health perceptions) and a composite mental health score (social functioning, general emotional well-being, role limitations due to emotional problems, and vitality). The physical health composite score was used to measure self-reported general health in the current study and demonstrated excellent internal consistency in the current sample ( $\alpha = .91$ ).

**Chronic burden.** To evaluate life events that may impact a participant's emotional experience, chronic burden data were also collected. The Chronic Burden scale (Gurung, Taylor, Kemeny, & Myers, 2004, Appendix N) was developed using focus groups with low income women at risk for HIV disease. This measure shows appropriate reliability in HIV-infected women and asks participants to report whether or not they experienced each of 22 events during the past month. Participants are then asked to indicate how much of a problem

each event has been for them on a 4-point Likert scale from 1=*not a problem for me in the last month* to 4=*A major problem for me in the last month*. Although two items possibly reflect burdens specific to women (“problems arranging childcare” and “being a caregiver for someone”), these items were maintained as women were included in the present study. Test-retest reliability of the Chronic Burden scale was reported as  $r = .60$  (Gurung et al., 2004). Internal consistency was not previously reported for this scale and was  $\alpha = .79$  in the current sample.

### **Statistical Analyses**

Data were analyzed using the SAS v 9.1 statistical program. Ordinary Least Squares regressions were used for all regression analyses. Tests of mediating effects were based on unstandardized coefficients and standard errors obtained from regression analyses (see Mediation model). To increase the interpretability of intercepts produced by the regression models, all continuous independent variables were centered around zero. Categorical data were reduced to dichotomous variables to reduce spurious variability. Specifically, ethnicity was recoded as African American vs. Caucasian; marital status was recorded as single vs. not single, income was coded as below \$10,000 vs. above \$10,000, education was coded as some college vs. no college, employment status was coded as on disability vs. not on disability, vector of infection was coded as sexual contact vs. other, liquor intake on day of cortisol collection was coded as yes/no, beer intake on day of cortisol collection was coded as yes/no. Point-biserial and Pearson product moment correlations between potential covariates (demographic variables, items on the cortisol log) and all dependent variables were examined to determine entry into the primary regression models reported here. Any potential covariates that were significantly correlated with DVs at  $p < .05$  were selected for entry into

primary regression models. Ratings of happiness and percent of day the participant felt happy on the cortisol log were each highly correlated with trait positive affect ( $r = .65, .62$  respectively), demonstrating consistency between reported trait positive affect and happiness on the day of cortisol collection. Thus, it was determined that it was unnecessary to control for happiness on the day of cortisol collection in primary regression analyses.

**Model assumption checks.** In order to ensure that data met the assumption requirements for regression analyses, all study variables were examined for missing data, univariate outliers, and univariate normality. The data were also examined for multivariate outliers, and residual errors were examined for normality, homoscedascity, and linearity. Finally, the data were checked for problems with multicollinearity and singularity (Tabachnick & Fidell, 2007). Some datapoints were observed to be missing (see Treatment of missing data section below) and univariate outliers and cases of univariate non-normality were also observed. Outlier data points were identified and winsorised (Tabachnick & Fidell, 2007) for number of adults living in home (two data points), average number of cigarettes smoked per day (one data point), total alcohol consumed this month (one data point), hours of sleep the night before cortisol collection (two data points), minutes of exercise on the day of cortisol collection (three data points), number of cigarettes smoked on the day of cortisol collection (one data point), negative affect (three data points) and cortisol (eight data points across five time collection points). A square root transformation was performed on minutes of exercise to reduce skewness. A natural log transformation was applied to total alcohol consumed this month and viral load to reduce skewness and kurtosis in these measures. Percent adherence was reflected and log transformed to reduce negative skewness (Tabachnick & Fidell, 2007). For participants whose viral load was undetectable,

.01 was entered as the value of their viral load in order to accommodate log transformation. Log transformation is often required to achieve a normal distribution for cortisol; however, after outliers were winsorised, cortisol scores were within recommended limits (i.e. skewness and kurtosis values less than 1.5) to be considered normally distributed. Several researchers have similarly found that raw cortisol data did not require transformation (Carlson, Specia, Patel, & Goodey, 2003; Moskowitz & Epel, 2006; Steptoe, Wardle, & Marmot, 2005).

**Treatment of missing data.** Only 41 individuals submitted salivary cortisol samples. Of these 41 samples, only 34 samples included sufficient saliva on the salivettes for all five time points and only these 34 complete sets were used for analyses involving cortisol. Seven (13%) clinician ratings (rHCMSS) were not received. Data for six individuals (11%) on the chronic burden scale were missing because the scale was inadvertently left out of those research packets. Some psychosocial data were not obtained because two participants did not complete all sections of the psychosocial interview and because two interview forms were inadvertently missing the final page of the RAND-36. In total, two participants were missing for positive affect and negative affect, three participants were missing the physical health composite score (RAND-36) and one participant was missing the negative health behaviors composite score. As the proportion of cases containing missing values exceeded the recommended 10% for imputing missing data (Allison, 2002), multiple imputation was used for all missing data except cortisol. Multiple imputation requires that data be missing at random, thus, dummy codes for missing and non-missing data were created for each variable which contained missing data. Point-biserial correlations between these dummy variables and all demographic variables were non-significant ( $ps > .25$ ), thus it was established that the data met the missing at random requirement (Allison, 2002). Missing data was imputed

using PROC MI in the SAS 9.1 statistical package. This technique uses an iterative maximum likelihood procedure to estimate missing values based on available participant data and incorporates random variation into the imputation process. Individual imputed datasets cannot be treated as “real” data due to low standard error estimates, thus multiple imputed data sets must be created (often between three and 10 data sets) and the variability in parameter estimates from these imputed data sets can be used for an upward adjustment of standard errors. The imputed data sets are each analyzed using traditional statistical analytic procedures (PROC REG in the current analyses) and then a special analysis (here, PROC MIANALYZE in SAS) is used to combine the parameter estimates from the imputed data sets to yield estimates that are “consistent, asymptotically efficient, and asymptotically normal” (Allison 2002, p. 27). The regression models reported here are based on the combined estimates of five imputed datasets.

**Mediation model.** The model for testing whether cortisol and health behaviors mediate relations between affect and health status was based on MacKinnon, Lockwood, Hoffman, West, and Sheets’ (2002)  $z' = \alpha\beta / \sigma_{\alpha\beta}$  formula for the product of coefficients. The  $z'$  formula is one of a number of approaches that focus on the significance of the total indirect effect as opposed to traditional causal steps approaches. Causal steps methods (e.g., Baron & Kenny, 1986) focus on demonstrating that the direct relation of the independent variable (IV) with the dependent variable (DV) is reduced or eliminated when the mediator is included as a predictor. There are four steps to the Baron and Kenny (1986) approach: 1) demonstrate a significant relation between the IV and DV; 2) demonstrate a significant relation between the IV and the mediator; 3) demonstrate a significant relation between the mediator and the DV; and 4) demonstrate that when the mediator is statistically controlled, the degree of the

relation between the IV and DV is reduced. Many methodologists (e.g., Kenny, 2009) now believe that only a significant indirect effect (i.e. the relation between the IV and the mediator multiplied by the relation between the mediator and the DV) is required to demonstrate mediation, and Kenny (2009) advises that coefficients of the individual steps are better described in terms of “zero” or “non-zero” rather than in terms of statistical significance as statistical significance is influenced by sample size. Product tests of indirect effects have gained popularity due to their overall better statistical power and more accurate Type 1 error rates compared to causal steps approaches. MacKinnon et al. (2002) showed that the  $z'$  product test demonstrated the highest statistical power and most accurate Type 1 error rate when compared to other tests of indirect effects using statistical simulation analyses. Given the number of analyses performed, alpha was set to .01 for all  $z'$  tests of significance to reduce family-wise error rate. All significance tests were one-tailed. Results significant at  $p < .05$  were considered marginally significant and were deemed relevant for discussion given that examining mechanisms of positive emotions is a relatively new area of analysis.

The coefficients and standard errors needed to calculate  $z' = \alpha\beta/\sigma_{\alpha\beta}$  are obtained by a two step process. First,  $\alpha$  is obtained by regressing each mediating variable on the IV(s) and any relevant control variables. Second,  $\beta$  is obtained by regressing each DV on each mediator, the independent variables, and any relevant control variables. Finally, the product of  $\alpha\beta$  is divided by a pooled error term that incorporates the standard errors of both  $\alpha$  and  $\beta$ . If the product test using coefficients derived from these regressions is significant, the proposed intervening variable is said to mediate the relation between the IV and DV. Because a product term is not a normally distributed variable,  $z'$  has a different sampling

distribution than the  $z$  distribution. The  $z'$  critical values were obtained at <http://www.public.asu.edu/~davidpm/ripl/mediate.htm> (MacKinnon et al., 2002).

## Results

### Sample Characteristics

Demographic characteristics of the sample (age, gender, and ethnicity) were reported in the Method section. A majority of the 53 participants ( $n = 32$ ; 64%) were on disability and 36 (72%) reported total household income under \$10,000. Eleven participants (21%) had not finished high school, 18 (34%) had graduated high school, four (8%) completed trade school beyond high school, 15 (28%) had completed some college level coursework, and five (9%) had completed a college or graduate degree. Five participants (9%) were married, 10 (19%) were divorced, four (8%) were widowed, six (11%) were separated, 26 (49%) were single/never married, and two (4%) were members of an unmarried couple. The average time since diagnosis was 12.4 years. Twenty-two participants (41%) reported they had been infected as a result of sexual contact with a male, 11 (21%) reported sexual contact with a female, four (8%) reported needle sharing, one (2%) reported blood transfusion, and 15 (28%) reported “other” or “unknown” method of infection.

**Emotion Reporting.** Descriptive statistics for all major study variables are shown in Table 1. In examining total affect scores (original and extended PANAS items), participants in the current study reported high levels of both positive affect (PA) and negative affect (NA) compared to the sample in Tugade and Fredrickson’s (2004) study (mean PA = 51.72 (SD = 11.66), mean NA = 26.68(SD = 6.12)). The Tugade and Fredrickson study was measuring current rather than trait affect, and affect scores increase as time frame of the measured reference period increases when using the PANAS (Watson, Clark, & Tellegen, 1988),



however, these scores likely reflect an elevation above and beyond that associated with the reference period. Other studies have documented elevated reporting of both positive and negative emotions in persons with HIV disease using the PANAS (e.g. DeMarco, Johnsen, Fukuda, & Deffenbaugh, 2001) and these elevated levels of reporting both positive and negative emotion may reflect the impact of living with a chronic stressor such as HIV infection. However, when just the original PANAS items were considered, mean trait affect in the current sample was comparable to means reported by Watson, Clark, and Tellegen (mean PA = 32.0 (SD = 7.0), mean NA = 19.5 (SD = 7.0)).

**Cortisol.** Participants in the current sample demonstrated waking and evening cortisol concentrations that were within the expected range. In healthy adults, cortisol concentrations upon awakening typically show a mean of .39 µg/dl and range from 0.11 to 1.55 µg/dl, and evening cortisol concentrations typically show a mean of .07 µg/dl and range from .02 to .36 µg/dl (Aardal & Holm, 1995). As shown in Table 1, the average waking cortisol was .34 µg/dl and evening cortisol was .22 µg/dl in the current sample. Although within the expected range, evening cortisol was somewhat high in the current sample. This may partly be due to final cortisol measurement at 9 pm in the current sample compared to 10 pm in the reference sample and could also reflect disruptions in normal circadian rhythm.

**Behavioral reporting.** Participants were prescribed to take an average of 4.5 pills per day for managing HIV disease with a range from one to 15 pills. This represents a downward shift from previous studies. Participants in a combination antiretroviral study reported being prescribed between 10 and 25 pills per day for managing HIV disease with a median of 16 pills (Chesney et al., 2000). This shift is to be expected with advancements in treatment and reflects the increasing use of combination therapies such as Atripla, Combivir,

Epzicom, Trizivir, and Truvada which combine multiple medications into a single pill. As shown in Table 1, the average percent medication adherence in the present study was 82%. Thirty-five participants (66%) reported 100% medication adherence during the past seven days, 10 (19%) reported 80-99% adherence, and eight (15%) reported 0-79% adherence. These three levels of adherence correspond to the stratifications used in validating the medication adherence measure and significant decreases in virologic and immunologic response to medication were associated with each descending level of adherence (Mannheimer, 2002). Of the 37 participants who submitted cortisol collection compliance information, 27 of these (73%) reported that they had “always” collected their saliva samples at the times indicated on the tubes, nine (24%) reported that they had collected at the appropriate time “most of the time” and one reported collecting saliva at the correct times “none of the time.” For correctly keeping the salivette in their mouth for two full minutes, 33 (89%) of the 37 reporting participants indicated that they had done so “all of the time” and four of these participants (11%) indicated doing so “most of the time.”

Thirty-two (61%) of the full sample of participants reported current smoking behavior. On average, participants reported smoking 43 cigarettes per week (see Table 1). The average number of total drinks in the past 30 days was 18 drinks. Thirty-nine (75%) reported some lifetime cocaine use and seven (14%) reported cocaine use in the last 30 days. For the remaining drug classes, 27% reported lifetime use of heroin, 17% lifetime use of heroin/cocaine combined, 12% lifetime use of opiates, and 21% lifetime use of amphetamines. One participant reported using opiates and amphetamines in the last 30 days and no participants reported heroin, heroin/cocaine use, or injecting any kind of drug in the

Table 1.

*Descriptive Statistics for All Continuous Major Study Variables (before data corrections).*

	Mean	SD	N
Total PA	63.02	16.01	51
Total NA	45.57	14.46	51
Original PANAS only PA	34.25	9.49	51
Original PANAS only NA	21.86	7.33	51
Extended PANAS items only PA	28.76	8.07	51
Extended PANAS items only NA	23.71	8.19	51
Waking Cortisol ( $\mu\text{g/dl}$ )	0.34	0.23	34
Evening Cortisol ( $\mu\text{g/dl}$ )	0.22	0.16	34
Percent Medication Adherence	.82	.34	53
Cigarettes per week	43.11	52.50	52
Alcoholic beverages in past 30 days	17.76	54.62	52
Physical Activity Score	2.25	0.68	53
Nutrition Score	2.34	0.47	53
CD4+ Total (cells/ $\mu\text{L}$ )	487.00	436.66	53
CD4+ Percent	.19	.09	53
CD4+/CD8+ Ratio	0.44	0.28	53
Viral Load (copies/ml)	11065.82	47848.93	53
rHCMSS	16.26	12.36	46
General Physical Health Score	59.59	9.18	50

past 30 days. Five participants (10%) reported having multiple sex partners in the past 30 days with number of reported partners ranging from zero to 20. Eight (16%) participants reported at least one incidence of unprotected vaginal or anal intercourse during the past 30 days.

**Health status.** As described in Table 1, mean CD4+ cell count for this sample was 487 cells/ $\mu$ L, with cell counts ranging from 12 to 2670. Healthy CD4+ cell counts range from approximately 400-1600 cells/ $\mu$ L (Lifson et al. 1991), thus the current sample likely reflects both CD4+ dysfunction and the high variability in this indicator. Twelve participants (23%) had CD4+ cell counts below 200 cells/ $\mu$ L, indicating immunologic progression to AIDS (CDC, 2004). Mean CD4+ percent in healthy adults has been estimated to be approximately 44% (Boffil et al., 1992) and mean CD4+ percent was 19.5% in the current sample. Mean CD4+/CD8+ ratio in healthy adults has been estimated to be 1.49 with a standard deviation of .57 (Jiang et al., 2004). Mean CD4/CD8 ratio was .44 in the current sample, 1.84 standard deviations below the mean ratio observed in healthy adults. Mean viral load in the current sample was 11,066 copies/ml, with 29 (55%) of participants demonstrating undetectable viral load. Undetectable viral load means that the number of copies of HIV present in the peripheral blood sample was below the minimum threshold of detection. Undetectable viral load is often interpreted as an indicator of successful HAART treatment (Ledergerber et al., 1999). The average of clinician-provided HIV symptom ratings using the rHCMSS was 16 out of a possible 39, which falls in the range of “minor symptoms.” Symptom scores in the sample ranged from 0 to 39, indicating a full range of current symptomatology from asymptomatic to severe AIDS-defining illnesses. Descriptive statistics of the health status indicators and all major study variables can be found in Table 1.

## **Preliminary Analyses**

Bivariate correlations between all study variables (presented in Table 2) were examined as a preliminary means of evaluating relations between all variables. The pattern of correlations indicated a number of significant relations across affect variables, mediator variables, and dependent variables, thus further evaluations of specific hypotheses were pursued.

## **Primary Analyses**

**Hypothesis 1: Total cortisol concentration mediates the direct relation between trait positive affect and improved health status.** If cortisol serves as a mediator between positive affect and health indicators in persons living with HIV disease, the product of the regression coefficients that make up the indirect effect should be statistically significant using the  $z'$  distribution. Regressions derived from multiple imputation were completed in order to obtain unstandardized regression coefficients and standard errors for conducting the product test. First, the mediator, AUCg, was regressed on both positive affect (PA) and negative affect (NA) and control variables. PA and NA were entered simultaneously to obtain coefficients that would reflect the relations for each type of affect after controlling for the effects of the other type of affect. Based on preliminary analyses (see *Statistical Analyses* section), chronic burden and smoking on the day of cortisol collection served as control variables for the prediction of AUCg. When the regression was completed for AUCg, a suppression effect was noted such that positive affect was suppressing the effect of negative affect when they were simultaneously entered into the model. A suppression effect is also known as inconsistent mediation (MacKinnon, Krull, & Lockwood, 2002). Inconsistent mediation occurs when a third variable (positive affect in this case) *increases* rather than

Table 2.

*Intercorrelations among Study Variables (N = 53 for all except AUCg, N = 34).*

	1	2	3	4	5	6	7	8
1. Positive Affect								
2. Negative Affect	-.51**							
3. AUCg	-.44**	.08						
4. Percent Adherence	.10	-.31*	.01					
5. Neg. Health Behaviors	-.64**	.46**	.25	-.17				
6. CD4+ Percent	.20	-.14	-.35*	.20	-.17			
7. Viral Load	-.05	.24	-.04	-.42**	.06	-.59**		
8. HIV symptoms	-.03	.09	.32*	.02	.08	-.22	-.04	
9. General Health	.46**	-.31*	-.29	.03	-.29	.02	-.11	-.16

\*p<.05, \*\*p<.01

decreases the relation between an IV (negative affect) and a DV (AUCg). Suppression is detected when the regression coefficient for the relation between the IV and DV is either greater than the bivariate correlation between the two variables or the sign of the coefficient is in the opposite direction of the correlation. The reason this occurs is typically because the suppressing variable (positive affect) explains variance in the suppressed variable (negative affect) (MacKinnon et al., 2002; Tabachnick & Fidell, 2007). The correlation between negative affect and AUCg (N = 34,  $r = .08$ ) was non-significant, but was positive, which is consistent with findings in previous research. When entered into a regression with positive affect, however; the sign of the unstandardized regression coefficient was negative ( $b = -$

2.89), indicating suppression had occurred. Due to the suppression effect, separate models were run regressing AUCg on positive and negative affect separately, as well as the same control variables described above. The unstandardized regression coefficient for positive affect dropped from  $b = -4.41$  in the PA-NA model to  $b = -3.42$  in the PA only model, suggesting that NA was similarly suppressing PA.

To obtain coefficients for the second half of the indirect effect (i.e. the coefficient of the relation between the mediator and the DVs controlling for the effects of the IV), CD4+ percent, viral load, HIV symptoms (rHCMSS), and general physical health (RAND-36) were each regressed (that is, in separate models) on the control variables, affect terms, (PA and NA entered into separate models again due to suppression effect), and AUCg entered as predictors. Chronic burden, ethnicity, and income were entered as control variables for CD4+ percent. Chronic burden and number of children residing with the participant were entered as control variables for viral load. Age, ethnicity, and disability status were entered as control variables for HIV symptoms. No control variables were entered for general health status. Among the four outcomes analyzed, a significant mediation result was found for one outcome, and two outcomes were marginally significant. Table 3 shows multiple regression results used to calculate product tests for hypothesis 1. Product tests using the coefficients and standardized errors obtained from the regression analyses demonstrated that AUCg mediated the relation between PA and CD4+ percent ( $z' = 1.11, p < .01$ ). Specifically, higher trait PA was associated with lower AUCg ( $\beta = -.35, p < .05$ ), and lower AUCg was associated with higher CD4+ percent ( $\beta = -.27, n.s.$ ). Figure 1 demonstrates the differences between persons reporting high vs. low trait positive affect in mean cortisol concentrations across the five saliva collection times. Figure 2 demonstrates the significant mediation

Table 3.

*Multiple Regression Results Testing AUCg as a Mediator of the Relation Between Trait Positive Affect and Health Indicators (N = 34).*

	<i>B</i>	<i>S.E</i>	<i>p</i>
Step 1 ( $\alpha$ ): IV = PA			
AUCg	-3.42	1.63	0.04
Step 2 ( $\beta$ ): IV = AUCg (controlling for PA and Control Variables)			
CD4+ percent	-0.02	0.01	0.19
Viral Load	-0.0004	0.003	0.91
rHCMSS	0.02	0.02	0.27
General Health	-0.01	0.01	0.97

described. AUCg was also a marginally significant mediator of the relation between PA and HIV symptoms ( $z' = -.98, p < .02$ ) and general health symptoms ( $z' = .78, p < .05$ ). Again, higher PA was associated with lower total cortisol concentration ( $\beta = -.35, p < .05$ ), and lower cortisol was associated with fewer HIV symptoms ( $\beta = .22, \text{n.s.}$ ) and better general health scores ( $\beta = -.17, \text{n.s.}$ ). AUCg did not mediate the relation between trait PA and viral load ( $z' = .12, p > .30$ ). None of the control variables were significantly associated with AUCg, CD4+ percent, HIV symptoms, or general health symptoms in regression analyses (all  $ps > .06$ ). Higher number of children residing with the participant was associated with higher viral load ( $\beta = .40, p < .05$ ).



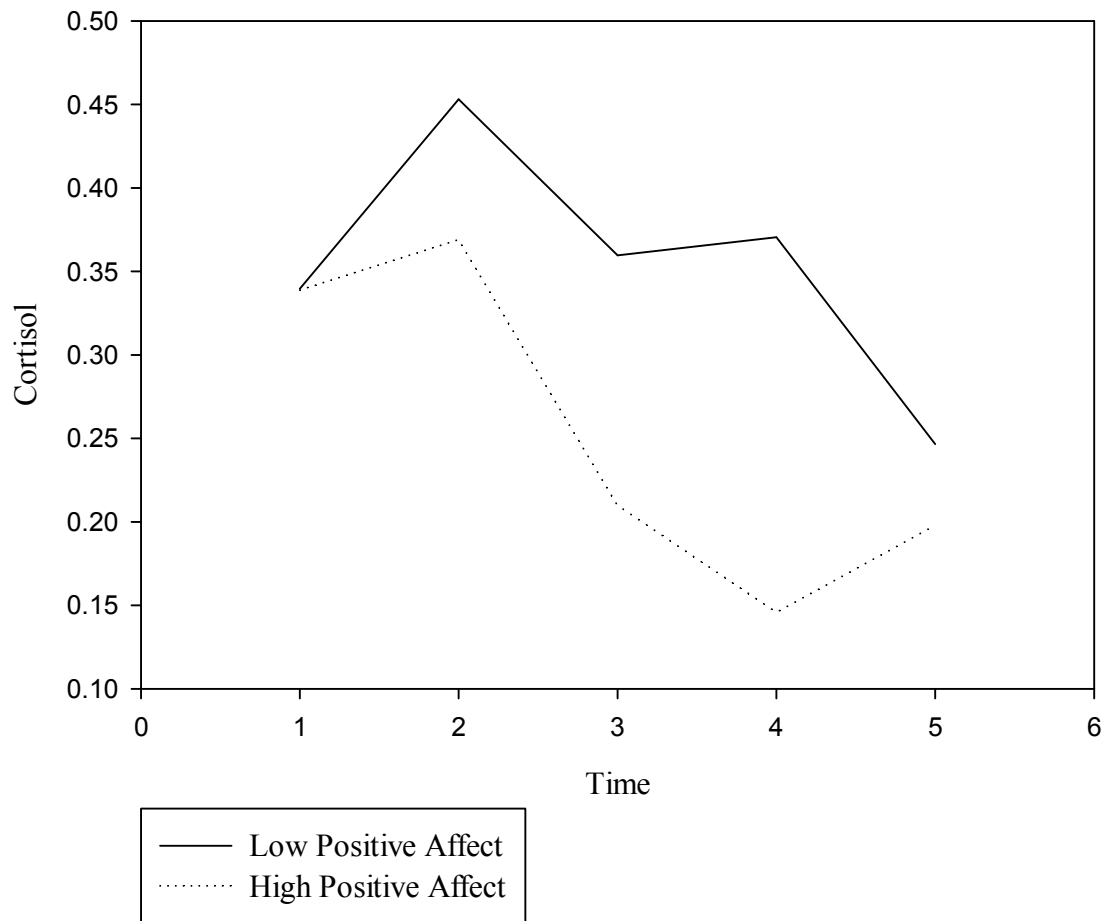
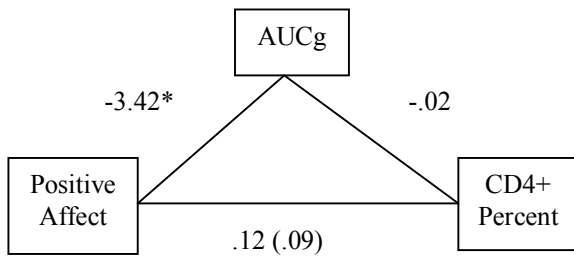


Figure 1. Different patterns in mean cortisol concentrations across 5 time points for persons reporting high vs. low trait positive affect



\* $p < .05$

Figure 2. AUCg mediates relation between high trait positive affect and high CD4+ percent. Numbers indicate unstandardized regression coefficients. Numbers in parentheses indicate the new coefficient after including the mediating variable.

**Hypothesis 2: Health behaviors and medication adherence mediate the direct relation between trait positive affect and improved health status.** In accordance with hypothesis 2, negative health behaviors (a composite score of alcohol and tobacco use, physical activity levels, and nutrition) and medication adherence were evaluated as potential mediators between PA and health status. Following the same multiple imputation procedure described above to obtain coefficients and standard errors, negative health behaviors and percent adherence were regressed on six control variables and affect terms. A suppression effect was not noted in the regression analyses conducted to obtain coefficients and standard errors for health behavior product tests. Therefore, PA and NA were entered simultaneously in all regressions for this product test in order to obtain coefficients that controlled for the effects of the other type of emotion. Control variables for negative health behaviors were education status, income, and vector of infection. Age was entered as a control variable for medication adherence. A suppression effect was again noted for PA and NA in the medication adherence model, so separate PA and NA models were utilized for product tests involving medication adherence. Next, CD4+ percent, viral load, HIV symptoms, and general health symptoms were regressed on the same control variables described above, the affect terms, and the health behaviors. Table 4 shows multiple regression results used to conduct product tests for hypothesis 2. Product tests revealed that neither medication adherence nor negative health behaviors mediated relations between PA and health status ( $z'$  values ranged from .08 to .37, all  $ps > .16$ ). None of the control variables were significantly associated with health behavior composite score or with medication adherence (all  $ps > .06$ ).

Table 4.

*Multiple Regression Results Testing Medication Adherence and Negative Health Behaviors as Mediators of the Relation Between Trait Positive Affect and Health Indicators (N = 53).*

	<i>B</i>	<i>S.E.</i>	<i>p</i>
Step 1 ( $\alpha$ ): IV = PA			
Medication Adherence	0.002	0.007	0.82
Negative Health Behaviors Index	-0.22	0.01	<.0001
Step 2 ( $\beta$ ): IV = Medication Adherence (controlling for PA and Control Variables)			
CD4+ percent	3.06	1.55	0.05
Viral Load	-1.30	1.40	.001
rHCMSS	0.50	2.24	0.82
General Health	-0.15	1.62	0.92
Step 2 ( $\beta$ ): IV = Negative Health Behavior Index (controlling for PA and Control Variables)			
CD4+ percent	-0.39	2.71	0.89
Viral Load	0.25	0.66	0.71
rHCMSS	0.74	3.41	0.82
General Health	0.26	2.33	0.91

**Hypothesis 3: Total cortisol concentration mediates the inverse relation between trait negative affect and improved health status.** Unstandardized coefficients and standard errors were derived from the multiple imputation regressions already described. AUCg was evaluated as a potential mediator of the relation between NA and health status variables. Table 5 shows multiple regression results used to calculate product tests for hypothesis 3.

Product test results indicated that AUCg did not mediate any relations between NA and health status indicators ( $z'$  ranged from .26 to .43, all  $ps > .14$ ).

Table 5.

*Multiple Regression Results Testing AUCg as a Mediator of the Relation Between Trait Negative Affect and Health Indicators ( $N = 34$ ).*

	<i>B</i>	<i>S.E</i>	<i>p</i>
Step 1 ( $\alpha$ ): IV = NA			
AUCg	0.86	1.93	0.66
Step 2 ( $\beta$ ): IV = AUCg (controlling for NA and Control Variables)			
CD4+ percent	-0.02	0.01	0.08
Viral Load	-0.001	0.003	0.75
rHCMSS	0.02	0.01	0.22
General Health	-0.02	0.01	0.12

**Hypothesis 4: Health behaviors and medication adherence mediate the inverse relation between trait negative affect and improved health status.** Unstandardized coefficients and standard errors obtained from multiple imputation-based regression analyses previously described were used to test both negative health behaviors and medication adherence as potential mediators of the relation between PA and health status in accordance with hypothesis 4. Table 6 shows multiple regression results used to calculate product tests for hypothesis 4. Medication adherence significantly mediated the relation between NA and CD4+ percent ( $z' = -1.33, p < .01$ ) and between NA and viral load ( $z' = 1.61, p < .01$ ). The direction of the individual coefficients were in the

Table 6.

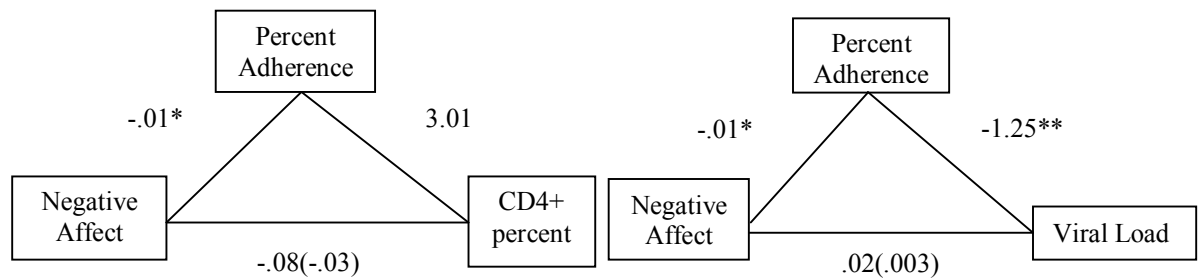
*Multiple Regression Results Testing Medication Adherence and Negative Health Behaviors as Mediators of the Relation Between Trait Negative Affect and Health Indicators (N = 53).*

	<i>B</i>	<i>S.E</i>	<i>p</i>
Step 1 ( $\alpha$ ): IV = NA			
Medication Adherence	-0.01	0.01	0.05
Negative Health Behaviors Index	0.01	0.01	0.21
Step 2 ( $\beta$ ): IV = Medication Adherence (controlling for NA and Control Variables)			
CD4+ percent	3.01	1.64	0.07
Viral Load	-1.25	0.43	0.004
rHCMSS	0.81	2.35	0.73
General Health	-0.82	1.78	0.02
Step 2 ( $\beta$ ): IV = Negative Health Behavior Index (controlling for NA and Control Variables)			
CD4+ percent	-0.39	2.71	0.89
Viral Load	0.25	0.66	0.71
rHCMSS	1.09	3.41	0.82
General Health	0.26	2.33	0.91

expected direction such that high negative affect was associated with lower percent medication adherence ( $\beta = -.26, p < .05$ ) and lower percent medication adherence was associated with lower CD4+ percent ( $\beta = .25$ , n.s.) and higher viral load ( $\beta = -.38, p < .01$ ). Figure 3 shows these mediation relations. Medication adherence did not mediate any relations between trait NA and HIV symptoms ( $z' = -.34, p > .19$ ) or NA and general health

( $z' = .45, p > .12$ ) Negative health behaviors did not mediate any relation between NA and health status indicators ( $z'$  ranged from .11 to .36, all  $ps > .17$ ).

**Hypothesis 5: Trait positive affect moderates the direct relation between high trait negative affect and increased total cortisol concentration, poorer medication adherence, and higher negative health behavior scores.** Upon examination of bivariate correlations for the data from the current sample, PA and NA were found to be



\*  $p < .05$  \*\*  $p < .01$

*Figure 3.* Percent medication adherence mediates the relations between high trait negative affect and lower CD4+ percent and higher viral load. All numbers indicate unstandardized regression coefficients. Numbers in parentheses indicate the new coefficient after including the mediating variable.

moderately correlated at  $r = -.51$  ( $N = 53$ ). According to Baron & Kenny (1986), evaluating moderation between variables with a moderate correlation is not recommended due to problems in interpretation. Specifically, “it is desirable that the moderator variable be uncorrelated with both the predictor and the criterion [the dependent variable] to create a clearly interpretable interaction term” (Baron & Kenny, 1986, p. 1174). When two variables are moderately inversely correlated (as in the current case), their interaction term is difficult to interpret because participants who are low on one measure tend to be high on the other measure. This moderate correlation was unexpected as the PANAS was selected for its relative independence of PA and NA. One possible reason for the higher correlation in this

sample was the inclusion of additional low-activation affect terms from Tugade and Fredrickson's (2004) extended version of the PANAS. The correlation between PA and NA including only the extended (low activation) items was  $r = -.55$  ( $N = 53$ ). However, in examining the correlation for only the original PANAS items (high activation), they were also moderately correlated at  $r = -.43$  ( $N = 53$ ). Even at this level, interpreting interactions would have to be viewed with extreme caution; thus, data in the current sample did not allow for exploration of a moderation hypothesis.

### **Secondary Analyses**

Although the composite negative health behavior variable was not found to mediate relations between affect and health status (Hypotheses 2 and 4), it was of interest to examine the relations of both PA and NA with the individual behaviors that were combined to create the health behavior composite (alcohol consumed in the past 30 days, cigarettes smoked per week, nutrition, and physical activity levels). Because these specific behaviors are likely to impact long-term health outcomes (USDHHS, 2000), it is possible that mediation was not confirmed in the current sample due to cross-sectional design. Future prospective analyses; however, could be justified by demonstration of a cross-sectional relation between trait affect and specific health behaviors. Each of these four health behaviors were regressed with control variables and both PA and NA entered simultaneously. Chronic burden, education, income, and vector of infection were entered as control variables for the smoking DV. Chronic burden and gender were entered as control variables for the alcohol DV. Education and income were entered as control variables for the physical activity DV. Education and number of children residing with the participant were entered as control variables for nutrition. After controlling for the effects of the control variables and NA, high reported

levels of trait PA were associated with lower alcohol consumption ( $F(4, 47) = 3.10, R^2 = .26, \beta = -0.35, p < .05$ ), greater physical activity ( $F(4, 48) = 3.89, R^2 = .24, \beta = 0.39, p < .01$ ), and better nutrition ( $F(4, 48) = 3.68, R^2 = .22, \beta = 0.34, p < .05$ ). PA was not significantly associated with the smoking DV ( $\beta = -.27, p < .07$ ). NA was not significantly associated with any of these behaviors after controlling for the effects of control variables and PA, (all  $ps > .36$ ). Vector of infection was significantly associated with the smoking DV such that persons infected by means other than sexual contact (i.e. intravenous drug use, blood transfusion, or “unknown” source of infection) reported smoking more cigarettes per week than those infected through sexual contact ( $\beta = -.34, p < .01$ ). No other control variables were significantly associated with health behaviors. Tables 7-9 display multiple regression results for alcohol intake, physical activity scores, and nutrition scores.

Table 7.

*Multiple Regression Results for Total Alcohol Intake in Past 30 Days and Trait Positive and Negative Affect (N = 52).*

Variable	$\beta$	t	p
Control			
Chronic Burden	0.12	0.83	0.41
Gender	0.20	1.55	0.12
Independent			
Positive Affect	-0.35	-2.28	0.02
Negative Affect	0.02	0.10	0.92



Table 8.

*Multiple Regression Results for Physical Activity Scores and Trait Positive and Negative Affect (N = 53).*

Variable	$\beta$	t	p
Control			
Education	0.17	1.36	0.18
Income	-0.16	-1.22	0.22
Independent			
Positive Affect	0.39	2.52	0.01
Negative Affect	-0.08	-0.55	0.58

Table 9.

*Multiple Regression Results for Nutrition Scores and Trait Positive and Negative Affect (N = 53).*

Variable	$\beta$	t	p
Control			
Education	0.16	1.25	0.21
# of Children	0.18	1.47	0.14
Independent			
Positive Affect	0.34	2.27	0.02
Negative Affect	-0.14	-0.90	0.37

## **Discussion**

The primary purpose of this study was to evaluate whether trait positive and negative emotions in persons living with HIV disease relate to neuroendocrine responding, health behaviors, and health status in a manner that is consistent with the biobehavioral model and the broaden-and-build theory of positive emotions. Specifically, cortisol, medication adherence, and negative health behaviors were examined as potential mechanisms of the relation between both positive and negative trait affect and health status in a sample of persons living with HIV disease. The current results partially support relations between trait positive and negative affect and HIV-specific health status that is mediated by physiological responses and health behaviors. These findings are discussed in more detail in what follows, according to each hypothesis evaluated.

### **Total Cortisol Concentration Mediates the Relation between Trait Positive Affect and Health Status**

The first hypothesis of this study stated that cortisol would mediate the relation between trait positive affect and four indicators of health status in persons with HIV disease (CD4+ percent, viral load, HIV symptoms, and general health). This hypothesis was developed in consonance with the upward spiral theory (Fredrickson, 2000) which states that positive affect is associated with the development of physical, psychological, social, and intellectual resources. This study demonstrated that total cortisol concentration measured across one day significantly mediated the relation between high trait positive emotions and better current health status as indicated by higher CD4+ percent. Lower AUCg also demonstrated marginally significant mediating relations between high trait positive affect and lower HIV symptoms and higher general health status. Thus, trait positive affect may be

associated with development of physical resources through enhanced neuroendocrine functioning (Fredrickson, 2000), which is in turn associated with improved health status in persons with HIV disease. This result extends previous findings that lower total cortisol concentration is generally associated with high levels of positive affect (Steptoe et al., 2005) and better health in healthy populations (Danner et al., 2001). This is the first known finding of this effect in a sample of persons with HIV disease.

### **Health Behaviors Mediate the Relation between Trait Positive Affect and Health Status**

Also consistent with Frederickson's (2000) upward spiral theory, health behaviors were hypothesized to mediate the relation between trait positive affect and better health status. Trait positive affect was associated with several adaptive health behaviors, specifically lower alcohol intake, greater physical activity, and better nutrition habits; however, no role was found for health behavior mediation of the affect – health status relations. Given that these behaviors are more likely to impact long term health (USDHHS, 2000) these behaviors may not yet have begun to demonstrate an effect on health due to the relatively young age of the current sample (average age was 44, range 22-56). Longitudinal studies or cross-sectional studies that specifically target older participants may bear out this mediating hypothesis. Ingledew and McDonaugh (1998) found that health behaviors can serve coping functions. Thus, current findings support the possibility that positive emotions contribute to the development of positive coping resources. The degree to which these behaviors impact HIV specific mechanisms is certainly equivocal; however, as persons living with HIV disease are now able to anticipate greater life expectancy than was the case in the pre-HAART era, targeting healthy lifestyles is of equal importance to enhancing medication adherence in managing HIV disease.

Inconsistent with hypothesis 2, medication adherence did not mediate the relation between high trait positive affect and better health status. Further, the bivariate correlation between positive affect and medication adherence was non-significant. Although previous studies have shown that depression is associated with poor medication adherence in persons living with HIV (Reynolds et al., 2004), no previous studies located have examined the relation between positive affect and medication adherence in persons living with HIV disease. The current study failed to support a relation between positive affect and medication adherence.

### **Total Cortisol Concentration Mediates the Relation between Trait Negative Affect and Health Status**

Hypothesis 3 stated that total cortisol concentration would mediate an association between high negative affect and poorer health status. This hypothesis was not supported in the current sample. This is inconsistent with previous findings that total cortisol concentration is associated with poor psychosocial functioning (e.g. Leserman et al., 2002) and poor health status (e.g. Polk, et al., 2005); however, such inconsistencies in cortisol data are not uncommon (Adam & Kumari, 2009). It is not clear why positive affect was associated with total cortisol concentration while negative affect was not in the current sample. As discussed in the Introduction, a consensus has not yet been reached about the best way to measure trait negative emotions as they relate to total cortisol concentration. It is possible that the extended version of the PANAS used in the current study may not be the ideal instrument for capturing the relation between trait negative affect and cortisol, although it showed promise in demonstrating the association between trait positive affect and cortisol. This could reflect a measurement problem with the PANAS in regard to capturing the

relation between trait negative affect and total cortisol concentration or a more general challenge with assessing trait negative affect. Polk et al. (2005) measured affect across six days over the course of two weeks and summed those ratings to develop an index of trait affect. The current study used a one-day retrospective report of emotions experienced over the past few weeks. Although the current method seems to have been effective in capturing a relation between trait positive affect and total cortisol, perhaps Polk et al.'s approach is more suitable for assessing trait negative affect as it may help to avoid retrospective biases that can be associated with global one-occasion reports.

As noted in the Introduction, few studies have focused on the relation between trait negative emotions and total cortisol concentration, and while one study has demonstrated a relation between high trait negative emotions and high total cortisol concentration (Polk et al, 2005) another study failed to demonstrate this effect (Hanson et al., 2000). Additional work is needed to determine if trait negative affect is truly associated with cortisol and to identify the best means of capturing this relation. Perhaps a more fine-grained approach that isolates specific trait emotions such as anger, sadness, or anxiety is necessary to clarify this relation. Denson, Spanovic, and Miller (2008) propose that classifying emotions into broad positive and negative categories is too non-specific to detect relations between emotion and cortisol responding. They have proposed an *integrated specificity model*, which posits that specific emotions produce specific physiological outcomes based on different survival demands. In support of their theory, they performed a meta-analysis in which trained judges determined the specific emotions and cognitive appraisals likely to be produced by specific experimental procedures. They compared the effect sizes of the relations between these procedures and measures of cortisol responding and found that surprise and cognitive appraisals of

challenge, novelty, and intensity were associated with elevated cortisol response. Other basic emotions (happy, sad, anticipation, disgust, anger, fear, and acceptance) were not associated with cortisol response according to their analysis. While these findings are specific to studies of experimentally manipulated state emotions, the specific emotion approach may also apply when measuring trait negative emotion.

Another possible explanation is offered by findings in a recent study by Wrosch, Miller, Lupien, and Pruessner (2008). They suggested that inconsistencies reported in the associations between psychosocial functioning, cortisol, and health status are related to failures to include other important health mediators in many studies. Specifically, in a sample of older adults, they found that high cortisol levels predicted increase in physical symptoms over the course of two years only if both trait negative affect and disturbances in sleep efficiency were also present. Interestingly, efficient sleep buffered against the prospective increase in physical symptoms that was associated with trait negative affect and cortisol. Sleep efficiency was not assessed in the current study, and perhaps the failure to demonstrate a mediating role of cortisol in the relation between trait negative affect and health status in the current sample is related to lack of inclusion of sleep efficiency or other important health mediators.

One final possible explanation is that although total cortisol concentrations throughout the day did not differ between participants reporting high and low trait negative affect, neuroendocrine dysfunction could still be present in the sample in that there could be alterations in circadian rhythm (e.g. flattened rhythm, nighttime rise, flattened slope, etc.) that were not considered in the current analysis (Adam & Kumari, 2009).

## **Health Behaviors Mediate the Relation between Trait Negative Affect and Health Status**

As predicted, high trait negative affect was associated with poorer medication adherence, and poor adherence mediated the relation between high trait negative affect and poorer health status as indicated by lower CD4+ percent and higher viral load. This is consistent with previous findings linking poor adherence to negative psychological functioning (Reynolds et al., 2004) and to poor immunologic and viral outcomes (Kitahata et al., 2004; Mannheimer, 2002). This further highlights the importance of targeting psychosocial factors in providing comprehensive HIV disease management. Inconsistent with hypothesis four, rates of smoking, drinking alcohol, physical activity levels, and nutrition habits did not mediate the relation between trait negative affect and health status. Health behaviors also did not mediate relations between trait positive affect and health status (hypothesis 2), although trait positive affect was associated with lower levels of alcohol intake, greater physical activity, and better nutrition habits. This failure to demonstrate mediation effects of health behaviors for both positive and negative affect may extend beyond the issues of cross-sectional design and the young age of the current sample. The presence of a chronic illness such as HIV disease may create downward pressure on the relation between affect, health behaviors, and health status in that the disease process may supercede any effects of health behaviors and affect.

## **Limitations and Future Research**

Although the current study adds to the growing literature on trait positive and negative emotions and physical health, there are some limitations to the present research that deserve discussion and that point to improvements for future research. The most important

limitation of this study is its cross-sectional design, which does not allow for causal interpretations of the current findings. One cannot rule out the possibility that emotional experience “over the past several weeks” (as was assessed here) had been influenced by health status, cortisol levels, or the practice of negative health behaviors. As mentioned in the Introduction on the relation between cortisol and depression, there likely are bi-directional relations between health status, neuroendocrine responding, behavioral functioning, and affect. However, the current findings help to provide a rationale for future prospective studies that can track the temporal relations between the variables assessed here, and in particular contribute further to the body of literature focused on the portion of the temporal chain in which psychosocial factors influence health outcomes.

A second limitation of the present research is also methodological, and concerns the measurement of diurnal cortisol. Salivary cortisol was assessed over the course of a single day and self-reported compliance data were collected in the current study. Single day salivary cortisol assessments are not uncommon in the literature (Adam & Kumari, 2009); however, collecting samples over a two to six day period would likely have provided better reliability in assessing the relation between trait affect and cortisol (Helhammer et al., 2007). Although participants reported high rates of compliance in the current study, a recent study using electronic monitoring of collection times of which the participants were unaware, demonstrated that participants reported 91% adherence to saliva collection protocol while their actual adherence was 73% (Broderick, Arnold, Kudielka, & Kirschbaum, 2004). Although electronic monitoring devices are costly, they enhance adherence, as demonstrated by findings that actual adherence increased to 90% in the group of participants who were made aware of the monitoring device in this study (Broderick et al., 2004). Future studies



that include longer periods of cortisol assessment and rigorous monitoring of salivary cortisol collection adherence could help to clarify answers to questions regarding the role of endocrine response in the relation between emotions and health status.

Another methodological limitation concerned the assessment of dietary nutrition. The measure used here, a subscale of the Health Promoting Lifestyle Profile II (HPLP II), demonstrated low internal consistency in the current sample ( $\alpha = .50$ ). This is significantly lower than the recommended minimum .70 for internal consistency (Nunnally & Bernstein, 1994). A review of the literature revealed two previous studies using the HPLP II in assessing health behaviors in persons living with HIV disease. One study included only women and reported an overall scale alpha of .92, but did not report alpha for the subscales (Riley, Lewis, Lewis, & Fava, 2008). The second study included only men and reported subscale alphas ranging from .80 - .90; however, this sample was primarily Caucasian males. Education attainment was similar to the current sample (53% of participants completed some post-high school training compared to 45% in the current sample). Income may have been higher in the previous study as the authors reported 81% of participants reported income <\$35,000 compared to 72% reporting income under <\$10,000 in the current sample (Uphold, Holmes, Reid, Findley, & Parada, 2007). Low internal consistency indicates that items on the scale do not correlate well with the overall scale score which could mean that certain items on the scale are not relevant to dietary habits in the current sample. Thus, findings in regard to nutritional habits in the current sample should be interpreted with caution, and replication of results will be necessary to confirm the relation between positive affect and nutrition habits. Further studies should also focus on determining if the HPLP II nutrition

subscale is an appropriate measurement tool in a population of primarily African American males living with HIV disease.

Finally, a statistical challenge in the present study was a higher than expected correlation between positive and negative affect that prevented meaningful tests of a moderating hypothesis (hypothesis 5). This may have occurred as a result of adding low-activation items to the original PANAS items, although Tugade and Fredrickson (2004) did not comment on whether a similar effect occurred when they used the extended PANAS. Although the correlation remained moderate when only original PANAS items were considered, the extended low-activation PANAS items were interspersed with the original items, and thus may have influenced responses to the original items. If future studies should include the extended version of the PANAS, perhaps administering all of the original items prior to the extended items would resolve this problem. Another possible explanation may be related to measurement of emotion in persons living with HIV disease. It is possible that the presence of a chronic stressor such as HIV infection could influence a person's tendency to experience both positive and negative affect. Thus, further investigation is needed to identify an optimal means of measuring trait affect in persons living with HIV disease.

## **Conclusions**

Overall, the current study provides some support for the use of the biobehavioral model (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Williams, Barefoot, & Schneiderman., 2003) and the broaden-and-build model of positive emotions (Fredrickson, 2000) as theoretical frameworks in studying the relations between trait affect and health status. Specifically, the biobehavioral model was supported in that both biological and behavioral mechanisms were found to mediate relations between trait affect and health status.

Further, the upward spiral of positive emotion was supported in that positive affect was associated with presence of advantageous physical and psychological resources represented by decreased neuroendocrine response and positive health behavior practices which may represent approach-based coping responses (Ingledew & McDonagh, 1998). The undoing effect of positive emotions remains unevaluated in the current sample as an unexpectedly high inverse correlation between trait positive and negative affect precluded exploration of a moderation hypothesis.

More generally, the current results contribute to growing evidence of a possible association between trait positive affect and decreased total cortisol concentration (Steptoe et al., 2005) and demonstrated a mediating role for cortisol between high trait positive affect and better immunologic status in persons living with HIV disease. The current study also contributes new findings on the association between trait positive affect and health behavior. Only one previously published study located has reported on an association between positive affective style and increased physical activity, better sleep, and improved zinc intake (Cohen et al., 2003). Current results replicate their findings with regard to physical activity and add reduced alcohol consumption and improved general nutrition as potential correlates of trait positive affect. Results from the current study also confirm previous findings that negative psychological functioning is associated with poor adherence to medication (Reynolds et al., 2004) and demonstrated that poor adherence may mediate the relation between high negative affect and poorer virulologic and immunologic status in persons living with HIV disease. The current results also draw attention to the possibility that health behaviors may not mediate relations between trait affect and health status in persons with HIV. This may reflect that the disease process puts downward pressure on this mediating relation such that immune

dysfunction overrides any potential benefits of positive health behaviors in persons living with HIV disease.

In summary, the current findings support the value of ongoing research investigating the impact of trait positive and negative affect on neuroendocrine, behavioral, and health outcomes. Future studies should seek to replicate and build upon the current findings by utilizing longitudinal design, longer periods of cortisol assessment, and more rigorous methods of monitoring participant adherence to salivary cortisol collection protocol.

Additional work is also needed to clarify the association between trait negative affect and total cortisol concentration as the current study failed to support some previous findings on this relation. Future studies could also help discern the best approach to measuring the relation between trait positive and negative emotions and cortisol by comparing multiple methods of assessment and by exploring the differential relations between cortisol and discrete emotions. Continuing efforts in this line of research will contribute to a greater understanding of the psychological, behavioral, and neuroendocrine factors that are associated with optimal health and well-being in primarily urban-dwelling African American persons living with HIV disease.

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Appendix A

Psychosis Screener

1. Have you ever seen or heard things that other people said were not real?

\_\_\_\_\_ yes      \_\_\_\_\_ no

2. Do you have beliefs that other people see as strange (examples include thinking that other people can read your thoughts or can insert thoughts into your mind, that people on the television are talking to you, or that you were someone else, like the president of the US)?

\_\_\_\_\_ yes      \_\_\_\_\_ no

3. Have you ever been diagnosed with schizophrenia?

\_\_\_\_\_ yes      \_\_\_\_\_ no

4. Have you ever been prescribed an antipsychotic medication?

\_\_\_\_\_ yes      \_\_\_\_\_ no

5. If you answered yes to any of the above questions, how recently have you experienced any of these symptoms?

\_\_\_\_\_ days ago      \_\_\_\_\_ months ago      \_\_\_\_\_ years ago

## Appendix B

### Informed Consent

#### **RESEARCH SUBJECT INFORMATION AND CONSENT FORM**

**TITLE: Biobehavioral mechanisms of emotion and HIV disease**

**VCU IRB NO.:** HM10378

This consent form may contain words that you do not understand. Please ask the study staff to explain any words that you do not clearly understand. If you wish, rather than starting the study now you may take home an unsigned copy of this consent form to think about or discuss with family or friends before making your decision.

#### **PURPOSE OF THE STUDY**

The aim of this project is to determine if feeling good helps patients with HIV disease to live healthy lives. Participation is voluntary, you are free to discontinue your participation at any time, and all responses will remain strictly confidential. Feel free to let the researcher know if you have any questions at any time during the study.

#### **DESCRIPTION OF THE STUDY AND YOUR INVOLVEMENT**

If you decide to be in this research study, you will be asked to sign this consent form after you have had all your questions answered and understand what will happen in the study. If you enroll, you will be asked to give a 10 mL tube of blood during your routine medical blood draw. Your blood may be selected as a subset of participants' blood for further analysis in the future. You will be asked to collect your saliva at home for 24 hours by chewing on a special piece of cotton at five time points during a day at home. Finally, you will be scheduled for an appointment to meet with a researcher for approximately 1 hour to complete an interview during which you will be asked to provide information about your emotions, behaviors, and health status. Some of these questions will be about your personal experiences with drug and alcohol use as well as sexual behaviors. Your medical chart will also be reviewed to determine your medical status. Your decision to participate or to not participate in this study in no way affects your medical care, and you do not have to answer any questions or participate in any activities you do not wish to. You may withdraw from the study at any time, without penalty.

#### **RISKS AND DISCOMFORTS**

You will be asked to give a 10 mL tube of blood for analysis, however, this blood will be drawn while you are already getting blood drawn for your routine medical care. Therefore, this study is not expected to pose any added physical risk or discomfort. Some people become uncomfortable when asked to share their feelings and behaviors, and some may be uncomfortable allowing researchers to access their medical records. Some may also fear that participating in a study will increase the risk of other people learning about their diagnosis. For this reason, your information will be kept confidential, and you will meet individually with a researcher either in the Infectious Disease Clinic or in the General Clinical Research Center at Virginia Commonwealth University Health Systems to complete all study measures. Thus, the risks are no greater than those of attending your medical appointments. Your participation in this study will in no way affect your medical treatment, and your medical providers will not have access to information you provide as part of your participation. If participating in this study causes you to feel upset or you become concerned about your psychological state or your current life situation, social workers are available in the clinic. If you desire individual therapy, the following resource is affordable and conveniently located:

- Center for Psychological Services and Development, which offers counseling services on a sliding fee scale; 612 N. Lombardy Street, Richmond phone 828-8069.

### **BENEFITS**

As compensation for volunteering your time, you will be given a gift card to Target in the amount of \$5, 2 GRTC bus tickets, and coupons to local restaurants and entertainment venues. Snacks and beverages will also be available to you at your interview appointment. In addition, as a participant in this study, you will automatically be entered into a raffle for a \$25 prize to be awarded at the completion of the study. Finally, although you may not experience any personal benefit from participating, you will be contributing to research that is intended to improve health and well-being for other persons living with HIV.

### **COSTS**

There are no costs for participating in this study other than the time you will spend completing questionnaires, collecting saliva samples, and returning to the clinic for your data collection appointment.

### **CONFIDENTIALITY**

Only research staff will have access to the information you give us and your physiological data, however, information from the study and the consent form signed by you may be looked at or copied for research or legal purposes by Virginia Commonwealth University. Your responses, however, will never be linked to you personally, because the data from the study will not be associated in any way with your consent form. What we learn from this study may be presented at meetings or published in papers, but your name will not ever be used in these presentations or papers.

### **VOLUNTARY PARTICIPATION AND WITHDRAWAL**

You do not have to participate in this study. If you choose to participate, you may stop at any time without any penalty. You may also choose not to answer particular questions that are

asked in the study if doing so makes you uncomfortable. Participating in this study in no way affects your medical care, and withdrawing from the study will also have no affect.

## **QUESTIONS**

In the future, you may have questions about your participation in this study. If you have any questions, contact:

Kirk Warren Brown, PhD  
Virginia Commonwealth University  
808 W. Franklin Street, Room 202  
P.O. Box 982018  
Richmond, VA 23284  
Telephone: 804-828-6754

If you have any questions about your rights as a participant in this study, you may contact:

Office for Research Subjects Protection  
Virginia Commonwealth University  
800 East Leigh Street, Suite 111  
P.O. Box 980568  
Richmond, VA 23298  
Telephone: 804-828-0868

## **WHY IS THE STUDY INVESTIGATOR DOING THIS STUDY?**

The conduct of research is an expected part of your study investigator's professional activity as a VCU faculty member.

## **CONSENT**

I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about the study have been answered. My signature says that I am willing to participate in this study.

---

Subject Name (please print)

---

Subject Signature Date

---

Name of Person Conducting Consent/Witness (please print)

---

Signature of Person Conducting Consent/Witness Date

---

Signature of Investigator Date

## Appendix C

### Saliva Collection Instructions

You will collect saliva five times during one day at home using special cotton in plastic tubes called salivettes. The timing of each of these samples is important because cortisol (a stress hormone) levels change over the course of the day. It is also important that the samples are received within three days of their collection. The researcher will discuss scheduling your saliva collection and drop off with you when you receive the salivettes. You will find that each salivette already has a label on it with your random data code and the time of day. Please make sure to use each tube at the appropriate time. You will collect the first sample as soon as you wake up, **before** you drink, eat, brush your teeth or smoke. Use the tube marked "waking" for this sample. Some people find it helpful to leave the first salivette by their bed to help them remember to do this first thing. You may then go about your normal activities, and will collect your second sample thirty minutes after you have woken up. Use the tube marked "30 minutes" for this sample. Then you will use the tube marked "12 noon" to collect at 12 noon, the tube marked "5 pm" at 5pm and the tube marked "9 pm" at 9 pm. Each sample can be collected by pulling the cotton out of the tube, placing it in your mouth and gently sucking or chewing on the cotton for two minutes in order to thoroughly saturate the cotton with saliva. Make sure that the cotton is very wet before placing it back into the tube. Place all the tubes back into the bag in which you received the salivettes and bring them with you to the clinic. A researcher will be available to receive your saliva. If the researcher is not available when you arrive, please ask the receptionist to place your bag in the researcher box. Please remember that the timing of the saliva samples is important, and that each time you take a sample, you should make sure to use the tube that is marked for the time of day that you are collecting.

Appendix D  
Demographic Form

1. What is your age?

\_\_\_\_\_ yrs

2. Sex?

Male    Female

3. Are you Hispanic or Latino?

Yes    No

4. How would you describe your race?

- \_\_\_\_\_ White
- \_\_\_\_\_ Black or African American
- \_\_\_\_\_ Asian
- \_\_\_\_\_ Native Hawaiian or Other Pacific Islander
- \_\_\_\_\_ American Indian or Alaska Native
- \_\_\_\_\_ Other (specify)

5. Are you...

- \_\_\_\_\_ Married
- \_\_\_\_\_ Divorced
- \_\_\_\_\_ Widowed
- \_\_\_\_\_ Separated
- \_\_\_\_\_ Never married
- \_\_\_\_\_ Member of an unmarried couple



6. What is the highest grade or year of school you completed?

- \_\_\_\_\_ < High School diploma
- \_\_\_\_\_ High School diploma
- \_\_\_\_\_ Trade school/ specialized training beyond High School
- \_\_\_\_\_ Some college
- \_\_\_\_\_ College degree
- \_\_\_\_\_ Graduate degree

7. Are you currently....

- \_\_\_\_\_ employed for wages
- \_\_\_\_\_ self-employed
- \_\_\_\_\_ out of work for more than 1 year
- \_\_\_\_\_ out of work for less than 1 year
- \_\_\_\_\_ a homemaker
- \_\_\_\_\_ a student
- \_\_\_\_\_ retired
- \_\_\_\_\_ on disability
- \_\_\_\_\_ other (please describe)

8. What is your annual household income from all sources?

- \_\_\_\_\_ less than \$10,000
- \_\_\_\_\_ \$10,000-15,000
- \_\_\_\_\_ \$15,000-\$20,000
- \_\_\_\_\_ \$20,000-\$25,000
- \_\_\_\_\_ \$25,000-\$30,000
- \_\_\_\_\_ \$30,000-\$35,000
- \_\_\_\_\_ \$35,000-\$50,000
- \_\_\_\_\_ \$50,000-\$75,000
- \_\_\_\_\_ over \$75,000

9. How many persons age 18 and older live in your household?

\_\_\_\_\_

10. How many persons under 18 live in your household?

\_\_\_\_\_

11. How long has it been since you were diagnosed with HIV?

\_\_\_\_\_ years    \_\_\_\_\_ months

12. How long has it been since you were infected with HIV?

\_\_\_\_\_ years    \_\_\_\_\_ months

13. How did you become infected with HIV?

\_\_\_\_\_ Sexual contact with a male

\_\_\_\_\_ Sexual contact with a female

\_\_\_\_\_ Sharing a needle

\_\_\_\_\_ Blood transfusion

\_\_\_\_\_ Other (please describe)

## Appendix E

### Cortisol Log

**Date:** \_\_\_\_\_

#### Salivette Schedule

Please collect your saliva samples in the salivettes provided to you on the following schedule. Please try to adhere as closely as possible to the schedule. Remember to put the piece of cotton in your mouth and suck or chew on the cotton **for at least 2 minutes**:

- 1) Immediately upon awakening (before getting out of bed, and before eating, drinking, smoking, or brushing your teeth)
- 2) 30 min after awakening
- 3) 12 noon
- 4) 5 pm
- 5) 9 pm

#### Activity Log

At bedtime after collecting all of your salivettes, please complete this log on **today's** activities.

1. What time did you awaken today? \_\_\_\_\_ am / pm (circle one)
2. How many hours of sleep did you get last night? \_\_\_\_\_
3. Please list all food and beverages that you consumed today, including the approximate amount of each:

- |          |           |
|----------|-----------|
| 1. _____ | 2. _____  |
| 3. _____ | 4. _____  |
| 5. _____ | 6. _____  |
| 7. _____ | 8. _____  |
| 9. _____ | 10. _____ |

4. If you did some form of exercise today, please indicate the activity/activities and the duration:

Type: \_\_\_\_\_ Duration: \_\_\_\_\_ minutes  
Type: \_\_\_\_\_ Duration: \_\_\_\_\_ minutes

5. If you consumed one or more alcoholic beverages today, please indicate how many of each:

\_\_\_\_\_ glass(es) of wine  
\_\_\_\_\_ beer(s)  
\_\_\_\_\_ drink(s) of hard liquor

6. If you smoked one or more cigarettes or cigars today, please indicate how many:  
\_\_\_\_\_ cigarette(s) / cigar(s) (circle one)

7. If you experienced symptoms of a (possible) illness today, please list those symptoms:

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

8. If you took any medications today, please list them and the amount of each:

Medication 1: \_\_\_\_\_ Dosage: \_\_\_\_\_ mg  
Medication 2: \_\_\_\_\_ Dosage: \_\_\_\_\_ mg  
Medication 2: \_\_\_\_\_ Dosage: \_\_\_\_\_ mg

Emotions Questionnaire:

9. Use the list below the answer the following question: How happy or unhappy do you feel today?

- \_\_\_\_\_ 10. Extremely happy (feeling ecstatic, joyous, fantastic!)  
\_\_\_\_\_ 9. Very happy (feeling really good, elated!)  
\_\_\_\_\_ 8. Pretty happy (spirits high, feeling good.)  
\_\_\_\_\_ 7. Mildly happy (feeling fairly good and somewhat cheerful.)  
\_\_\_\_\_ 6. Slightly happy (just a bit above neutral.)  
\_\_\_\_\_ 5. Neutral (not particularly happy or unhappy.)  
\_\_\_\_\_ 4. Slightly unhappy (just a bit below neutral.)  
\_\_\_\_\_ 3. Mildly unhappy (just a little low.)  
\_\_\_\_\_ 2. Pretty unhappy (somewhat "blue," spirits down.)  
\_\_\_\_\_ 1. Very unhappy (utterly depressed, completely down.)

10. Consider your emotions a moment further. Today, what percent of the time did you feel happy? What percent of the time did you feel unhappy? What percent of the time did you feel neutral (neither happy nor unhappy)? Write down your best estimates, as well as you can, in the spaces below. Make sure the three figures add-up to equal 100%.

Today

The percent of time I felt happy	_____ %
The percent of time I felt unhappy	_____ %
The percent of time I felt neutral	_____ %
Total	_____ %

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**Women only:**

9. Were you menstruating today?    Yes    No    (circle one)

10. If you used an oral contraceptive today, please indicate what type:

\_\_\_\_\_

## Appendix F

### Extended PANAS

**DIRECTIONS:** This scale consists of a number of words that describe different feelings and emotions.

Check (☑) the box on each 5-point scale corresponding to the extent that you have experienced each emotion during the past few weeks.

1. Interested

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

2. Distressed

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

3. Excited

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

4. Upset

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

5. Strong

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

6. Guilty

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

7. Scared

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

8. Hostile

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

9. Enthusiastic

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

10. Proud

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

11. Amused

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

12. Anxious

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

13. Calm

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

14. Curious

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**15. Disappointed**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**16. Disgusted**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**17. Relaxed**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**18. Sad**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**19. Surprised**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**20. Irritable**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**21. Alert**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**22. Ashamed**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

**23. Inspired**

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐



24. Nervous

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

25. Determined

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

26. Attentive

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

27. Jittery

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

28. Active

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

29. Afraid

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

30. Angry

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

31. Blue

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

32. Content

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

33. Depressed

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

34. Discouraged

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

35. Happy

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

36. Relieved

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

37. Satisfied

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

38. Tired

1. Very slightly or  
not at all

☐

2. A little

☐

3. Moderately

☐

4. Quite a bit

☐

5. Very Much

☐

## Appendix G

### Terry Beirn Community Programs for Clinical Research on AIDS Medication Adherence Scale (TBCPCRA)

#### Section A:

##### To be completed by research staff with study participant.

Complete the following information with the patient for each antiretroviral drug prescribed during any of the past 7 days. Please write in the name of the drug below. For pills that are temporarily discontinued, record "00" for "Total # of pills per day."

#### Section B:

##### To be completed by study participant

Many people have trouble taking all their pills all of the time. For each drug listed in Section A, indicate how many of your pills you took during the last 7 days (check only one answer for each drug listed). Please answer all of the questions as honestly and carefully as possible. How you answer these questions will not affect your care or participation in this study. If you are unsure about a question, please give the best answer you can.

#### SECTION A:

<u>Drug Name</u>	<u># of Pills</u> <u>per dose</u>	<u># of Doses</u> <u>per day</u>	<u>Total # of</u> <u>pills/day</u>
------------------	--------------------------------------	-------------------------------------	---------------------------------------

#### SECTION B:

<u>All of</u> <u>my pills</u> <u>everyday</u>	<u>MOST</u> <u>of my</u> <u>pills</u>	<u>About</u> <u>ONE-HALF</u> <u>of my pills</u>	<u>VERY FEW</u> <u>of my pills</u>	<u>NONE</u> <u>of my pills</u>
---	---	---	---------------------------------------	-----------------------------------

_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____
_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____
_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____
_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____
_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____
_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____
_____	_____ X _____ =	_____	_____	_____	_____	_____	_____	_____

### Section C

**To be completed by study participant. Do not answer these questions if you took all your pills every day during the last 7 days for every drug listed. (Check all that apply.)**

1. During the last 7 days, what part of the day did you usually **MISS** taking your antiretroviral drugs?

- ☐ In the morning (upon waking until 12 noon)
- ☐ In the afternoon (between 12 noon and 5 p.m.)
- ☐ In the evening (between 5 p.m. and 9 p.m.)
- ☐ At night (9 p.m. until waking the next morning)

2. Below are some reasons why people miss taking their antiretroviral drugs. Check “Yes” or “No” to indicate whether or not each of the following reasons describes why you usually **MISSED** taking your antiretroviral drugs during the last 7 days:

- |  | Yes                      | No                       |
|--|--------------------------|--------------------------|
| a. I feel worse when I take the pills  | <input type="checkbox"/> | <input type="checkbox"/> |
| b. There are too many pills to take  | <input type="checkbox"/> | <input type="checkbox"/> |
| c. I forget to take the pills  | <input type="checkbox"/> | <input type="checkbox"/> |
| d. I ran out of pills  | <input type="checkbox"/> | <input type="checkbox"/> |
| e. I don't think I need the pills  | <input type="checkbox"/> | <input type="checkbox"/> |
| f. I was away from home  | <input type="checkbox"/> | <input type="checkbox"/> |
| g. I did not want others to notice   | <input type="checkbox"/> | <input type="checkbox"/> |
| h. I am too busy   | <input type="checkbox"/> | <input type="checkbox"/> |
| i. I had problems taking the pills at specified times (with meals, on empty stomach, etc.) | <input type="checkbox"/> | <input type="checkbox"/> |
| j. I was confused or uncertain about how to take the pills                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Other (please explain)  | <input type="checkbox"/> | <input type="checkbox"/> |

---

---

## Appendix H

### Health Promoting Lifestyles Profile II

---

This questionnaire contains statements about your *present* way of life or personal habits

**DIRECTIONS:** Please indicate how often you engage in each behavior by checking in the box below:

1. Discuss my problems and concerns with people close to me.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

2. Choose a diet low in fat, saturated fat, and cholesterol.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

3. Report any unusual signs or symptoms to a physician or other health professional.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

4. Follow a planned exercise program.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

5. Get enough sleep.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

6. Feel I am growing and changing in positive ways.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

7. Praise other people easily for their achievements

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

8. Limit use of sugars and foods containing sugar.

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

9. Read or watch TV programs about improving health.

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

10. Exercise vigorously for 20 minutes at least three times a week (such as brisk walking, bicycling, aerobic dancing, using a stair climber).

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

11. Take some time for relaxation each day

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

12. Believe that my life has a purpose.

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

13. Maintain meaningful and fulfilling relationships with others.

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

14. Eat 6-11 servings of bread, cereal, rice, and pasta each day.

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

15. Question health professionals in order to understand their instructions.

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

16. Take part in light to moderate physical activity (such as sustained walking 30-40 minutes 5 or more times per week).

1. Never  
☐

2. Sometimes  
☐

3. Often  
☐

4. Routinely  
☐

17. Accept those things in my life which I can not change.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

18. Look forward to the future.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

19. Spend time with close friends.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

20. Eat 2-4 servings of fruit each day.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

21. Get a second opinion when I question my health care provider's advice.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

22. Take part in leisure-time (recreational) physical activities (such as swimming, dancing, bicycling).

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

23. Concentrate on pleasant thoughts at bedtime.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

24. Feel content and at peace with myself.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

25. Find it easy to show concern, love, and warmth to others.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

26. Eat 3-5 servings of vegetables each day.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

27. Discuss my health concerns with health professionals.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

28. Do stretching exercises at least 3 times a week.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

29. Use specific methods to control my stress.

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

30. Work toward long-term goals in my life.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
31. Touch and am touched by people I care about.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
32. Eat 2-3 servings of milk, yogurt, or cheese each day.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
33. Inspect my body at least monthly for physical changes/danger signs.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
34. Get exercise during usual daily activities (such as walking during lunch, using stairs instead of elevators, parking car away from destination and walking).
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
35. Balance time between work and play.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
36. Find each day interesting and challenging.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
37. Find ways to meet my needs for intimacy.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
38. Eat only 2-3 servings from the meat, poultry, fish, dried beans, eggs, and nuts food group each day.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
39. Ask for information from health professionals about how to take good care of myself.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
40. Check my pulse rate when exercising.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
41. Practice relaxation or meditation for 15-20 minutes daily.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
42. Am aware of what is important to me in life.
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Never                 | 2. Sometimes             | 3. Often                 | 4. Routinely             |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



43. Get support from a network of caring people.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

44. Read labels to identify nutrients, fats, and sodium (salt) content in packaged foods

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

45. Attend educational programs on personal health care.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

46. Reach my target heart rate when exercising.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

47. Pace myself to prevent tiredness.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

48. Feel connected with some force greater than myself.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

49. Settle conflicts with others through discussion and compromise.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

50. Eat breakfast.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

51. Seek guidance or counseling when necessary.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

52. Expose myself to new experiences and challenges.

1. Never

☐

2. Sometimes

☐

3. Often

☐

4. Routinely

☐

## Appendix I

### Alcohol Quantity Frequency Variability Measure

**ALCOHOL USE:** The next section asks about drinking alcohol. A drink is one 12 ounce can or bottle of beer (or wine cooler), 1 glass of wine, or 1 shot of liquor.

1. During the past 30 days, on how many days did you have at least one drink of alcohol:

\_\_\_\_\_ days/30

2. During the past 30 days, how many alcoholic drinks did you **usually** have in one day on the days that you drank (remember that one drink is one 12 ounce can or bottle of beer (or wine cooler), 1 glass of wine, or 1 shot of liquor)?

\_\_\_\_\_ average drinks in one day

3. During the last 30 days, what is the most number of alcoholic drinks you had in one day?

\_\_\_\_\_ most drinks in one day

4. Referring to your answer to question 3, on how many days did you have that “most number of drinks” during the last 30 days?

\_\_\_\_\_ days/30

## Appendix J

### Tobacco Frequency Measure

1. Have you smoked at least 100 cigarettes in your entire life? **(if no, go to next section)**

Yes / No

2. Do you currently smoke every day, some days, or not at all? **(If not at all, skip to question 5)**

Every day / Some days / Not at all \*\*\*If some, how many days? \_\_\_\_\_

3. What kind of cigarettes do you smoke (regular, light, ultra light, menthol)?

4. How many cigarettes do you smoke on days that you smoke (a pack is 20 cigarettes)?

\_\_\_\_\_ cigarettes/day

5. If you have quit smoking, how long has it been since you quit smoking cigarettes?

\_\_\_\_\_ years \_\_\_\_\_ months

6. For how many years did you smoke cigarettes?

\_\_\_\_\_ years

7. When you smoked, how many cigarettes did you smoke per day (a pack is 20 cigarettes)?

\_\_\_\_\_ cigarettes

8. In the last 30 days, how many days have you used smokeless tobacco, or smoked pipes or cigars?

\_\_\_\_\_ days/30

**Interviewer fill in:** Years smoked \_\_\_\_\_ x Packs smoked per day \_\_\_\_\_ = \_\_\_\_\_  
pack years.

## Appendix K

### Risk Behavior Survey

#### A. DRUG USE:

**INTERVIEWER:** “I’m going to ask you some questions about your drug use. I’ll ask what types of drugs you’ve used and how often you use them.”

##### 1. Cocaine by itself

**1a.** Have you ever used **Cocaine by itself (injected or snorted)**?

*If no use, skip to next drug, Q 2a.*

No ☐ 0

Yes ☐ 1

Refused ☐ 7

Unknown ☐ 9

**1b.** How many days did you use **Cocaine by itself** in the last 30 days?

*If 00, do not ask Q 1c-f, and skip to next drug, Q 2a.*

**1c.** How many days did you inject **Cocaine by itself** in the last 30 days?

*If 00, skip to Q 1e.*

**1d.** How many times a day did you inject **Cocaine by itself**?

*Average # of injections/day*

**1e.** How many days did you use **Cocaine by itself** without injecting (smoking, snorting, swallowing) in the last 30 days?

*If 00, then skip to next drug, Q 2a.*

**1f.** How many times a day did you use **Cocaine by itself** without injecting? \_\_\_\_

##### 2. Heroin by itself

**2a.** Have you ever used **Heroin by itself**?

*If no use, skip to next drug, Q 3a.*

No ☐ 0

Yes ☐ 1

Refused ☐ 7

Unknown ☐ 9

**2b.** How many days did you use **Heroin by itself** in the last 30 days?

*If 00, do not ask Q 2c-f, and skip to next drug, Q 3a.*

\_\_\_\_ 8

**2c.** How many days did you inject **Heroin by itself** in the last 30 days?

*If 00, skip to Q 2e.*

\_\_\_ \_\_ <sup>9</sup>

**2d.** How many times a day did you inject **Heroin by itself**?

*Average # of injections/day*

\_\_\_ \_\_ <sup>10</sup>

**2e.** How many days did you use **Heroin by itself** without injecting (smoking, snorting, swallowing) in the last 30 days?

*If 00, then skip to next drug, Q 3a.*

\_\_\_ \_\_ <sup>11</sup>

**2f.** How many times a day did you use **Heroin by itself** without injecting? \_\_\_ \_\_ <sup>12</sup>

### **3. Heroin & Cocaine Mixed Together**

**3a.** Have you ever used **Heroin & Cocaine mixed together (speedball)**?

*If no use, skip to next drug, Q 4a.*

No ☐ 0

Yes ☐ 1

Refused ☐ 7

Unknown ☐ 9

**3b.** How many days did you use **Heroin & Cocaine mixed together** in the last 30 days?

*If 00, do not ask Q 3c-f, and skip to next drug, Q 4a.*

\_\_\_ \_\_

**3c.** How many days did you inject **Heroin & Cocaine mixed together** in the last 30 days?

*If 00, skip to Q 3e.*

\_\_\_ \_\_

**3d.** How many times a day did you inject **Heroin & Cocaine mixed together**?

*Average # of injections/day*

\_\_\_ \_\_

**3e.** How many days did you use **Heroin & Cocaine mixed together** without injecting (smoking, snorting, swallowing) in the last 30 days?

*If 00, then skip to next drug, Q 4a.*

\_\_\_ \_\_

**3f.** How many times a day did you use **Heroin & Cocaine mixed together** without injecting?

\_\_\_ \_\_

#### 4. Other Opiates

**4a.** Have you ever used **Other Opiates (Demerol, Codeine, Dilaudid)**?

*If no use, skip to next drug, Q 5a.*

No ☐0

Yes ☐1

Refused ☐7

Unknown ☐9

**4b.** How many days did you use **Other Opiates** in the last 30 days?

*If 00, do not ask Q 4c-f, and skip to next drug, Q 5a.*

\_\_\_ \_\_<sup>20</sup>

**4c.** How many days did you inject **Other Opiates** in the last 30 days?

*If 00, skip to Q 4e.*

\_\_\_ \_\_<sup>21</sup>

**4d.** How many times a day did you inject **Other Opiates**?

*Average # of injections/day*

\_\_\_ \_\_<sup>22</sup>

**4e.** How many days did you use **Other Opiates** without injecting (smoking, snorting, swallowing) in the last 30 days?

*If 00, then skip to next drug, Q 5a.*

\_\_\_ \_\_<sup>23</sup>

**4f.** How many times a day did you use **Other Opiates** without injecting? \_\_\_ \_\_<sup>24</sup>

#### 5. Amphetamines

**5a.** Have you ever used **Amphetamines (Methamphetamine, Speed, Crank)**?

*If no use, skip to Section B, Drug Injection.*

No ☐0

Yes ☐1

Refused ☐7

Unknown ☐9

**5b.** How many days did you use **Amphetamines** in the last 30 days?

*If 00, do not ask Q 5c-f, and skip to Section B, Drug Injection.*

\_\_\_ \_\_

**5c.** How many days did you inject **Amphetamines** in the last 30 days?

*If 00, skip to Q 5e.*

\_\_\_ \_\_

**5d.** How many times a day did you inject **Amphetamines**?

*Average # of injections/day*

\_\_\_ \_\_

**5e.** How many days did you use **Amphetamines** without injecting (smoking, snorting, swallowing) in the last 30 days?

*If 00, then skip to Section B, Drug Injection.*

\_\_\_ \_\_\_

**5f.** How many times a day did you use **Amphetamines** without injecting? \_\_\_ \_\_\_

## **B. DRUG INJECTION**

*IF NO INJECTION USE IN PAST 30 DAYS, SKIP TO SECTION C.*

**1.** In the last 30 days, how many times (# of injections) did you inject using works (needle/syringes) that **you know** had been used by somebody else?

*If 0, then skip to B3.*

\_\_\_ \_\_\_ \_\_\_<sup>31</sup>

**2.** Of the times you injected after someone, how many times did you clean the works with full-strength bleach?

*Number cannot exceed total number of times used after another person (B1).*

\_\_\_ \_\_\_ \_\_\_<sup>32</sup>

**3.** How many times in the last 30 days did you use a cooker/cotton/rinse water that had been used by another injector?

\_\_\_ \_\_\_ \_\_\_<sup>33</sup>

**4.** How many times in the last 30 days did you fix drugs with another person, then split the drug solution (through use of the same cooker/spoon or through front or back loading)?

\_\_\_ \_\_\_ \_\_\_<sup>34</sup>

## **C. SEXUAL ACTIVITY**

**INTERVIEWER:** "Now I'm going to ask you some questions about sex. I'm referring here to anybody you've had sex with in the last 30 days."

**1.** During the last 30 days, with how many people did you have vaginal, oral or anal sex?

*IF NONE, ENTER 000 AND THE QUESTIONNAIRE IS COMPLETED.*

\_\_\_ \_\_\_ \_\_\_<sup>35</sup>

**2.** How many of your partners were female?

*Number cannot exceed total number of people (C1).*

\_\_\_ \_\_\_ \_\_\_<sup>36</sup>

**3.** How many of your partners were male?

*Number cannot exceed total number of people (C1).*

\_\_\_ \_\_\_ \_\_\_<sup>37</sup>

**4. INTERVIEWER:** Code gender of respondent.

*If Male, complete sections D, E, F, G & I.*

*If Female, complete sections D, G, H, & I.*

*If Don't Know, ask ALL gender specific questions and allow client to answer as they like.*

Male ☐ 1

Female ☐ 2

Don't Know ☐ 9

**D. Ask MALE/FEMALE Clients who had FEMALE PARTNERS:**

**1a.** How many women performed oral sex ("went down") on you? \_\_\_ \_\_\_ \_\_\_

*Number cannot exceed total number of female partners (C2).*

*If 0, then skip to question 2a.*

**1b.** How often did your partner(s) perform oral sex ("go down") on you?

Once or irregularly ☐ 1

Less than once a week ☐ 2

About once a week ☐ 3

2-6 times a week ☐ 4

About once a day ☐ 5

2-3 times a day ☐ 6

4 or more times a day ☐ 7

Refused ☐ 77

Don't know/unsure ☐ 99

**1c.** How often did you use condoms/dental dams when your partner(s) performed oral sex ("went down") on you?

Never ☐ 0

Less than half the time ☐ 1

About half the time ☐ 2

More than half the time ☐ 3

Always ☐ 4

Don't know/unsure ☐ 7

Refused ☐ 9

**2a.** How many women did you perform oral sex ("go down") on? \_\_\_ \_\_\_ \_\_\_

*Number cannot exceed total number of female partners (C2).*

*If 0, then skip to next section appropriate for the gender of this client.*



**2b.** How often did you perform oral sex (“go down”) on your partner(s)?

Once or irregularly ☐1

Less than once a week ☐2

About once a week ☐3

2-6 times a week ☐4

About once a day ☐5

2-3 times a day ☐6

4 or more times a day ☐7

Refused ☐77

Don’t know/unsure ☐99

**2c.** How often did you use condoms/dental dams when you performed oral sex (“went down”) on your partner(s)?

Never ☐0

Less than half the time ☐1

About half the time ☐2

More than half the time ☐3

Always ☐4

Don’t know/unsure ☐7

Refused ☐9

**E. Ask MALE Clients who had FEMALE PARTNERS:**

**1a.** How many women did you have vaginal sex with?

*Number cannot exceed total number of female partners (C2).*

*If 0, then skip to question 2a.*

\_\_\_ \_\_\_ \_\_\_ 45

**1b.** How often did you have vaginal sex? Once or irregularly ☐1

Less than once a week ☐2

About once a week ☐3

2-6 times a week ☐4

About once a day ☐5

2-3 times a day ☐6

4 or more times a day ☐7

Refused ☐77

Don’t know/unsure ☐99

**1c.** How often did you use a condom?

Never ☐0

Less than half the time ☐1

About half the time ☐2

More than half the time ☐3

Always ☐4

Don’t know/unsure ☐7

Refused ☐9

**2b.** How often did you have (insertive) anal sex?

Once or irregularly ☐ 1

Less than once a week ☐ 2

About once a week ☐ 3

2-6 times a week ☐ 4

About once a day ☐ 5

2-3 times a day ☐ 6

4 or more times a day ☐ 7

Refused ☐ 77

Don't know/unsure ☐ 99

**2c.** How often did you use a condom?

Never ☐ 0

Less than half the time ☐ 1

About half the time ☐ 2

More than half the time ☐ 3

Always ☐ 4

Don't know/unsure ☐ 7

Refused ☐ 9

**2a.** How many women did you have (insertive) anal sex with? \_\_\_\_

*Number cannot exceed total number of female partners (C2).*

*If 0, then skip to next section appropriate for the gender of this client.*

**F. Ask MALE Clients who had MALE PARTNERS:**

**1a.** How many men did you have (insertive) anal sex with?

*Number cannot exceed total number of male partners (C3).*

*If 0, then skip to next section appropriate for the gender of this client.*

\_\_\_\_ 51

**1b.** How often did you have (insertive) anal sex?

Once or irregularly ☐ 1

Less than once a week ☐ 2

About once a week ☐ 3

2-6 times a week ☐ 4

About once a day ☐ 5

2-3 times a day ☐ 6

4 or more times a day ☐ 7

Refused ☐ 77

Don't know/unsure ☐ 99

**1c.** How often did you use a condom?

Never ☐0

Less than half the time ☐1

About half the time ☐2

More than half the time ☐3

Always ☐4

Don't know/unsure ☐7

Refused ☐9

**G. Ask MALE/FEMALE Clients who had MALE PARTNERS:**

**1a.** How many men performed oral sex ("went down") on you? \_\_\_\_ \_

*Number cannot exceed total number of male partners (C3).*

*If 0, then skip to question 2a.*

**1b.** How often did your partner(s) perform oral sex ("go down") on you?

Once or irregularly ☐1

Less than once a week ☐2

About once a week ☐3

2-6 times a week ☐4

About once a day ☐5

2-3 times a day ☐6

4 or more times a day ☐7

Refused ☐77

Don't know/unsure ☐99

**1c.** How often did you use condoms/dental dams when your partner(s) performed oral sex ("went down") on you?

Never ☐0

Less than half the time ☐1

About half the time ☐2

More than half the time ☐3

Always ☐4

Don't know/unsure ☐7

Refused ☐9

**2a.** How many men did you perform oral sex ("go down") on? \_\_\_\_ \_

*Number cannot exceed total number of male partners (C3).*

*If 0, then skip to next section appropriate for the gender of this client.*

**2b.** How often did you perform oral sex (“go down”) on your partner(s)?

Once or irregularly ☐ 1

Less than once a week ☐ 2

About once a week ☐ 3

2-6 times a week ☐ 4

About once a day ☐ 5

2-3 times a day ☐ 6

4 or more times a day ☐ 7

Refused ☐ 77

Don’t know/unsure ☐ 99

**2c.** How often did you use condoms/dental dams when you performed oral sex (went down”) on your partner(s)?

Never ☐ 0

Less than half the time ☐ 1

About half the time ☐ 2

More than half the time ☐ 3

Always ☐ 4

Don’t know/unsure ☐ 7

Refused ☐ 9

**H. Ask FEMALE Clients who had MALE PARTNERS:**

**1a.** How many men did you have vaginal sex with?

*Number cannot exceed total number of male partners (C3).*

*If 0, then skip to next section appropriate for the gender of this client.*

\_\_\_ \_\_\_ \_\_\_ 60

**1b.** How often did you have vaginal sex?

Once or irregularly ☐ 1

Less than once a week ☐ 2

About once a week ☐ 3

2-6 times a week ☐ 4

About once a day ☐ 5

2-3 times a day ☐ 6

4 or more times a day ☐ 7

Refused ☐ 77

Don’t know/unsure ☐ 99

**1c.** How often did you use a condom?

Never ☐0

Less than half the time ☐1

About half the time ☐2

More than half the time ☐3

Always ☐4

Don't know/unsure ☐7

Refused ☐9

**I. Ask MALE/FEMALE Clients who had MALE PARTNERS:**

**1a.** How many men did you have (receptive) anal sex with?

*Number cannot exceed total number of male partners (C3).*

*IF 0, END QUESTIONNAIRE.*

**1b.** How often did you have (receptive) anal sex?

Once or irregularly ☐1

Less than once a week ☐2

About once a week ☐3

2-6 times a week ☐4

About once a day ☐5

2-3 times a day ☐6

4 or more times a day ☐7

Refused ☐77

Don't know/unsure ☐99

**1c.** How often did you use a condom?

Never ☐0

Less than half the time ☐1

About half the time ☐2

More than half the time ☐3

Always ☐4

Don't know/unsure ☐7

Refused ☐9

## Appendix L

### Revised HIV Center Medical Staging System (rHCMSS)

Scoring Instructions: Based on history and physical examination data, but independent of CDC classification and immune status, derive a numerical score between 0 and 39 to categorize an individual's HIV-specific health status. **First**, categorize the individual by one of the major stages: Asymptomatic, Minor Symptoms, Major Symptoms, or AIDS. **Second**, categorize the severity of current symptomatology within the designated stage by assigning a score from 0-9, 10-19, 20-29, or 30-39. Note that cumulative scores are assigned for any history or current evidence of a given symptom. ANCHORED INDICATORS ARE APPROXIMATIONS ONLY; actual scores may include all integers and are based on clinical judgment.

#### 1. Interview participant

#### 2. Check medical record

_____	0-9	<b>Asymptomatic:</b> Physical symptoms may be attributed to HIV infection, but are not, in themselves, of clinical concern <b>0</b> ≈ No history of symptoms <b>5</b> ≈ Minor fatigue (less than 25 % reduction in normal activity) <b>9</b> ≈ Greater than usual upper respiratory infections									
_____	10-19	<b>Minor Symptoms:</b> Limited, but clinically significant symptoms which are not included below (e.g. persistent generalized lymphadenopathy, oral or vulvovaginal candida, skin and nail infections or rashes, constitutional symptoms of limited duration, episodic diarrhea, fatigue with 25-50% reduction in normal activity, cervical dysplasia [CIN 1-2]) <b>10</b> ≈ Persistent generalized lymphadenopathy <b>15</b> ≈ ≤ 2 symptom episodes: List _____ <b>19</b> ≈ ≥ 3 symptom episodes: List _____									
_____	20-29	<b>Major Symptoms:</b> Serious physical symptoms, but not AIDS-defining conditions, including the following (check if applicable): <table border="0" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 50%; vertical-align: top;">               _____ Oral hairy leukoplakia                _____ Pelvic inflammatory disease (PID)                _____ Fever &gt; 30 days                _____ Pneumococcal bacteremia                _____ Peripheral neuropathy                _____ Fatigue &gt; 30 days                _____ Weight loss &gt; 10% body wt.             </td> <td style="width: 50%; vertical-align: top;">               _____ Night sweats &gt; 30 days                _____ Salmonella septicemia (once)                _____ Cervical dysplasia (CIN 3)                _____ Diarrhea &gt; 30 days                _____ H. influenza bacteremia                _____ Herpes zoster                _____ Idiopathic thrombocytopenia purpura (ITP)             </td> </tr> </table>	_____ Oral hairy leukoplakia _____ Pelvic inflammatory disease (PID) _____ Fever > 30 days _____ Pneumococcal bacteremia _____ Peripheral neuropathy _____ Fatigue > 30 days _____ Weight loss > 10% body wt.	_____ Night sweats > 30 days _____ Salmonella septicemia (once) _____ Cervical dysplasia (CIN 3) _____ Diarrhea > 30 days _____ H. influenza bacteremia _____ Herpes zoster _____ Idiopathic thrombocytopenia purpura (ITP)							
_____ Oral hairy leukoplakia _____ Pelvic inflammatory disease (PID) _____ Fever > 30 days _____ Pneumococcal bacteremia _____ Peripheral neuropathy _____ Fatigue > 30 days _____ Weight loss > 10% body wt.	_____ Night sweats > 30 days _____ Salmonella septicemia (once) _____ Cervical dysplasia (CIN 3) _____ Diarrhea > 30 days _____ H. influenza bacteremia _____ Herpes zoster _____ Idiopathic thrombocytopenia purpura (ITP)										
Other: _____ <table border="0" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 33%;"><b>20</b> ≈ ≤ 2 symptom episodes</td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> <tr> <td><b>25</b> ≈ Recurrent major symptom episodes</td> <td></td> <td></td> </tr> <tr> <td><b>29</b> ≈ Chronic and/or multiple major symptom episodes</td> <td></td> <td></td> </tr> </table>			<b>20</b> ≈ ≤ 2 symptom episodes			<b>25</b> ≈ Recurrent major symptom episodes			<b>29</b> ≈ Chronic and/or multiple major symptom episodes		
<b>20</b> ≈ ≤ 2 symptom episodes											
<b>25</b> ≈ Recurrent major symptom episodes											
<b>29</b> ≈ Chronic and/or multiple major symptom episodes											
_____	30-39	<b>AIDS:</b> Any AIDS-indicator condition, including the following (check if applicable): <table border="0" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 50%; vertical-align: top;">               _____ Candidiasis, esophageal or pulmonary                _____ Coccidioidomycosis                (disseminated [ds] or extrapulmonary [ep])                _____ Cryptococcosis (ep)                _____ Cryptosporidiosis, chronic intestinal             </td> <td style="width: 50%; vertical-align: top;">               _____ Isosporiasis, chronic intestinal                _____ MAC, M. kansasii or other (ds, ep)                _____ M. tuberculosis, any site                _____ Pneumocystis carinii pneumonia (PCP)                _____ Recurrent pneumonia             </td> </tr> </table>	_____ Candidiasis, esophageal or pulmonary _____ Coccidioidomycosis (disseminated [ds] or extrapulmonary [ep]) _____ Cryptococcosis (ep) _____ Cryptosporidiosis, chronic intestinal	_____ Isosporiasis, chronic intestinal _____ MAC, M. kansasii or other (ds, ep) _____ M. tuberculosis, any site _____ Pneumocystis carinii pneumonia (PCP) _____ Recurrent pneumonia							
_____ Candidiasis, esophageal or pulmonary _____ Coccidioidomycosis (disseminated [ds] or extrapulmonary [ep]) _____ Cryptococcosis (ep) _____ Cryptosporidiosis, chronic intestinal	_____ Isosporiasis, chronic intestinal _____ MAC, M. kansasii or other (ds, ep) _____ M. tuberculosis, any site _____ Pneumocystis carinii pneumonia (PCP) _____ Recurrent pneumonia										

- |  |   |
|--|---|
| <input type="checkbox"/> Cytomegalovirus (not liver, spleen, or nodes) | <input type="checkbox"/> Progressive multifocal leukoencephalopathy   |
| <input type="checkbox"/> Recurrent Salmonella septicemia               | <input type="checkbox"/> Encephalopathy (AIDS-related dementia)   |
| <input type="checkbox"/> Toxoplasmosis of brain                        | <input type="checkbox"/> Histoplasmosis (ds, ep)  |
| <input type="checkbox"/> Wasting syndrome                              | <input type="checkbox"/> Herpes simplex (chronic, esophagus, pulmonary)   |
|  | Malignancy, SPECIFY: <input type="checkbox"/> KS <input type="checkbox"/> lymphoma <input type="checkbox"/> invasive cervical |
- 30** ≈ ≤ 2 AIDS-indicator illness episodes and/or conditions of limited severity  
**35** ≈ Recurrent indicator conditions  
**39** ≈ Chronic and/or multiple opportunistic infections

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## Appendix M

### RAND 36-Item Health Survey (RAND-36)

**DIRECTIONS:** Please answer each question below:

1. In general would you say your health is:

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Excellent             | 2. Very good             | 3. Good                  | 4. Fair                  | 5. Poor                  |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

2. Compared to one year ago, how would you rate your health in general now?

1. Much better now	2. Somewhat better now	3. About the same	4. Somewhat worse now	5. Much worse now
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

c. Lifting or carrying groceries.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



d. Climbing several flights of stairs.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

e. Climbing one flight of stairs.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

f. Bending, kneeling or stooping.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

g. Walking more than one mile.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

h. Walking several blocks.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

i. Walking one block

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

j. Bathing or dressing yourself.

1. Yes, limited a lot.	2. Yes, limited a little	3. No not limited at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

a. Cut down the amount of time you spent on work or other activities?

☐ Yes ☐ No

b. Accomplished less than you would like?

☐ Yes ☐ No

c. Were limited in the kind of work or other activities

☐ Yes ☐ No

d. Had difficulty performing the work or other activities (for example, it took extra time)

☐ Yes ☐ No

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

a. Cut down the amount of time you spent on work or other activities?

☐ Yes ☐ No

b. Accomplished less than you would like

☐ Yes ☐ No

c. Didn't do work or other activities as carefully as usual

☐ Yes ☐ No

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

1. Not at all

☐

2. Slightly

☐

3. Moderately

☐

4. Quite a bit

☐

5. Extremely

☐

7. How much bodily pain have you had during the past 4 weeks?

1. Not at all	2. Slightly	3. Moderately	4. Quite a bit	5. Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

1. Not at all	2. Slightly	3. Moderately	4. Quite a bit	5. Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks.

a. did you feel full of pep?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b. have you been a very nervous person?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

c. have you felt so down in the dumps nothing could cheer you up?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

d. have you felt calm and peaceful?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

e. did you have a lot of energy?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

f. have you felt downhearted and blue?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

g. did you feel worn out?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

h. have you been a happy person?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

i. did you feel tired?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

1. All of the time	2. Most of the time	3. A good bit of the time	4. Some of the time	5. A little of the time	6. None of the time
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. How TRUE or FALSE is each of the following statements for you?

a. I seem to get sick a little easier than other people

1. Definitely true	2. Mostly True	3. Don't know	4. Mostly false	5. Definitely false
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b. I am as healthy as anybody I know

1. Definitely true	2. Mostly True	3. Don't know	4. Mostly false	5. Definitely false
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

c. I expect my health to get worse

1. Definitely true	2. Mostly True	3. Don't know	4. Mostly false	5. Definitely false
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

d. My health is excellent

1. Definitely true	2. Mostly True	3. Don't know	4. Mostly false	5. Definitely false
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Appendix N

### Chronic Burden

Please indicate if each of the following stressors has happened over the past month and how much of a problem these events have been for you. (HAND SUBJECT CARD No. \_\_\_\_\_)

4 = A major problem for me in the last month

3 = Somewhat of a problem for me in the last month

2 = A little bit of a problem for me in the last month

1 = Not a problem for me in the last month

#### Degree of Stress

1. Not having enough money to cover the basic needs of life  
(food, clothing, housing) \_\_\_\_\_
2. Not having any savings to meet problems that come up \_\_\_\_\_
3. No reliable source of transportation (such as a car that  
works of reliable bus service) \_\_\_\_\_
4. Housing problems (uncertainty about housing, problems  
with landlord, needing to find a new place to live) \_\_\_\_\_
5. Being a caregiver for someone (taking care of someone  
sick, elderly, infirmed) \_\_\_\_\_
6. Divorce or separation from partner \_\_\_\_\_
7. Long term, unresolved conflict with someone very  
important to you (child, parents, lover/partner,  
sibling, friend) \_\_\_\_\_
8. Being fired or laid off \_\_\_\_\_
9. Trouble with your employer (in danger of losing job,  
being suspended or demoted) \_\_\_\_\_
10. Having work hours or responsibilities change for the worse \_\_\_\_\_
11. Partner's work hours or responsibilities change for the worse \_\_\_\_\_

12. Serious accident, injury or new illness which happened to  
you or a close family member/spouse/partner/close friend \_\_\_\_\_

IF YES, Who was that? (RECORD RELATIONSHIP OR "SELF")

\_\_\_\_\_  
13. You or a close family member/spouse/partner, close friend  
were the victim of a crime or physical assault? \_\_\_\_\_

IF YES, Who was that? (RECORD RELATIONSHIP OR "SELF")

\_\_\_\_\_  
14. Chronic pain or restriction of movements due to injury or  
illness \_\_\_\_\_

15. Long-term medical problems \_\_\_\_\_

16. Having immigration or citizenship problems, either  
you or someone you are close to and depend on. \_\_\_\_\_

IF YES, Who was that? (RECORD RELATIONSHIP OR "SELF")

\_\_\_\_\_  
17. You or close family member/spouse/partner/close friend  
was arrested or sent to jail. \_\_\_\_\_

IF YES, Who was that? (RECORD RELATIONSHIP OR "SELF")

\_\_\_\_\_  
18. Living in a high-crime area \_\_\_\_\_

19. Losing the help of someone you depend on (person moved,  
got sick or otherwise was unavailable) \_\_\_\_\_

20. Being discriminated against because of your race,  
nationality, gender, sexual orientation, HIV status \_\_\_\_\_

21. Other long-term problem. Please Specify. \_\_\_\_\_

\_\_\_\_\_

## Vita

Karen Elaine Stewart was born in Annapolis, MD on October 31, 1976 and is a United States citizen. She received her Bachelor's of Science in Psychology from the College of William & Mary in 1998, and a Master's of Science in Clinical Psychology from Mississippi State University in 2002. She completed her clinical internship in Health Psychology at Rush University Medical Center in 2009. She has provided disease management and psychotherapy services to patients and families living with a wide range of chronic illnesses including diabetes, cancer, multiple sclerosis, HIV disease, sleep disorders, and many more. She was awarded a Ruth L. Kirschstein Predoctoral National Research Service Award towards the completion of this project and advanced training in biobehavioral research.