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The Daily Relationship Between Food Insecurity and Medication Adherence Among People Living with HIV

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Jennifer Ann Pellowski, PhD

University of Connecticut, 2015

Limited access to resources based on social position can significantly impact health behaviors. Previous research on food insecurity and HIV has focused on establishing the relationship between food insecurity and antiretroviral (ARV) medication non-adherence in a variety of social contexts (i.e. resource poor and resource rich environments). However, one main caveat of these studies is the level of analysis. Previous studies have used cross-sectional and longitudinal studies that concentrate on the individual level of analysis. However, these study designs do not allow for a true test of whether ARV medication non-adherence occurs on days with limited access to food.

The current study utilized a prospective, observational design to test the daily relationship between food insecurity and medication non-adherence. Fifty-nine adults living with HIV were enrolled. They were followed for 45 days and completed daily assessments of food insecurity and alcohol use via two way text message surveys. Participants also used Wisepill devices to assess daily medication adherence. Results showed that severe food insecurity (i.e. hunger) significantly predicted missed doses of medication on a daily level. This relationship was moderated by alcohol use but not geospatial factors. Additionally, psychosocial factors did not mediate this relationship. There are several potential explanations for this daily relationship including competing resource demands and food requirements of prescriptions. Future research should tease apart these potential explanations in order to better understand the daily relationship between food insecurity and medication non-adherence and the ways that we can intervene.

The Daily Relationship Between Food Insecurity and Medication Adherence
Among People Living with HIV

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B.A., University of Connecticut, 2011

M.A., University of Connecticut, 2013

A Dissertation
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Requirements for the Degree of
Doctor of Philosophy
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2015

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Jennifer Ann Pellowski

2015

APPROVAL PAGE

Doctor of Philosophy Dissertation

The Daily Relationship Between Food Insecurity and Medication Adherence
Among People Living with HIV

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CHAPTER I: Syndemic of Social Disadvantage and Poverty

Human immunodeficiency virus (HIV) has spread globally over the past 34 years creating a destructive pandemic. Since it was discovered, more than 39 million people have died from AIDS-related complications (World Health Organization, 2014). As of 2013, the World Health Organization (WHO) estimated that there were 35 million people living with HIV/AIDS with 2.1 million new infections occurring each year globally (WHO, 2014). In the United States, there are more than 1.2 million people living with HIV and approximately 47,000 new infections each year (Centers for Disease Control and Prevention [CDC], 2015a).

Although HIV transmission is a biological event, it entirely depends on social context and behavior (Strathdee, Magis-Rodriguez, Mays, Jimenez, & Patterson, 2012). For these reasons, HIV infection is clustered among socially marginalized groups in the U.S. (Pellowski, Kalichman, Matthews & Adler, 2013). HIV prevalence rates are highest among racial minorities; African Americans are eight times more likely to contract HIV than Whites (CDC, 2015b) and African Americans also account for 44% of all new HIV infections (CDC, 2015b). HIV also disproportionately impacts sexual minorities. Men who have sex with men (MSM) accounted for 63% of new HIV infections in 2010 (CDC, 2015c). Finally, HIV is also most prevalent in areas with greater income inequality and poverty-stricken neighborhoods (El-Sadr, Mayer, & Hodder, 2010; Fuller et al., 2005; Gant, Lomotey, Hall, Guo & Song, 2012; Latkin, Williams, Wang, & Curry, 2005).

HIV is unlike many chronic diseases; most chronic diseases fall along a socioeconomic status (SES) gradient such that chronic illnesses impact individuals on all levels of the gradient, however, individuals with relatively lower SES are more likely to have a chronic illness than

those higher on the gradient (Adler & Ostrove, 1999; Adler & Stewart, 2010). HIV infections, however, are largely concentrated among those with very low SES with very few individuals with high SES contracting HIV (CDC, 2011; Pellowski, Kalichman, Matthews, & Adler, 2013).

Individuals in poverty face a myriad of social disadvantages, which have direct implications for health and well-being (Lynch, Smith, Kaplan, & House, 2000; Reif, Whetten, Lowe, & Ostermann, 2006; Young et al., 2006). They live in areas with high crime rates, overcrowding, restricted access to nutritious food, violence, drugs and restricted access to social services. Singer (2009) states that these types of social disadvantage and disparities are the primary cause of syndemics. Syndemics are when two or more disease epidemics intersect and this intersection synergistically exacerbates the resulting negative health effects of those diseases (Singer & Clair, 2003). Syndemics are distinct from comorbidities such that comorbidities are diseases that co-occur but are either not epidemics or they do not result in this synergistic exacerbation of negative health effects (Mustanski, Garofalo, Herrick, & Donenberg, 2007).

The term syndemic has been used extensively in the HIV literature when discussing how the HIV epidemic interacts with a variety of other factors including depression (Wawrzyniak et al., 2015), abuse experiences (Pitpitan et al., 2013), violence against women (Montgomery et al., 2015), environmental changes (Talman, Bolton, & Walson, 2013), drinking alcohol (Oldenburg, Perez-Brumer & Reisner, 2014) injection drug use (Bulled & Singer, 2011) and food insecurity (Singer, 2009). These different syndemics are not surprising when thinking about HIV as a pandemic of the poor. The theory of fundamental causes (Link & Phelan, 1995) proposes that the link between SES and health disparities is because “SES embodies an array of resources, such as money, knowledge, prestige, power, and beneficial social connections that protect health no matter what mechanisms are relevant at any given time” (Phelan, Link, & Tehranifar, 2010, p.

S28). All of the HIV syndemics mentioned can be traced to a lack of one or more of these resources. Thus, it is no surprise that health disparities, particularly HIV, are so prevalent among people who are socially disadvantaged.

When discussing and researching these syndemics of social disadvantage in the United States, we must consider multiple levels of factors that can influence the mental and physical health of individuals. Johnson et al.'s (2010) network-individual-resources (NIR) model proposes that we must consider influences of networks, individual characteristics, as well as resources. Although Johnson et al.'s (2010) model is mostly focused on HIV prevention, these ideas can be extended to those living with HIV. Johnson et al.'s (2010) secondary prevention principle elucidates the necessity of tangible and mental resources not only to ensure treatment as prevention (TasP; Cohen et al., 2011; 2013) but also for the individual living with HIV to survive and thrive. To obtain optimal adherence to their medications, individuals living with HIV must have tangible resources including food, shelter, money to purchase their medications, and transportation to get to their doctor and pharmacy. These individuals must also have mental resources to not only cope with their disease but also to adequately carry out the necessary mental components of the behavior of medication adherence.

We must consider the competing demands that exist for these resources. Hobfoll (1989) proposes that psychological stress originates from perceived and actual loss or gain of resources in one or a combination of the following ways: “(a) the threat of a net loss of resources, (b) the net loss of resources, or (c) a lack of resource gain following the investment of resources” (pp. 516). In this theory, Hobfoll (1988, 1989) defines resources in much the same way that Johnson et al. (2010) does; resources may be personal characteristics or tangible resources. Also similar to Johnson et al. (2010), Hobfoll (1989) considers the impact of individuals within environments

and acknowledges that “environmental circumstances often threaten or cause a depletion of people’s resources” (pp. 516). While the model of conservation of resources (Hobfoll, 1989) has been used widely in industrial organizational psychology, particularly when discussing work burnout (Halbesleben, 2006), there is also a small literature that has used it within the public health domain. Hobfoll & Jackson (1991) argue that community interventions to address physical and psychological health must acknowledge the importance of resources and specifically address issues in an ecological framework to be successful.

Pellowski, Kalichman, Matthews, & Adler (2013) have combined many of the ideas presented, thus far, to discuss health disparities within the U.S. HIV epidemic. My co-authors and I propose a framework that incorporates individual and social-structural level factors to begin to explain the health disparities in HIV across the lifespan (See Appendix A for a figure of this framework). The influence of socioeconomic position and the tangible resources (or lack there of) that accompany this status influence health behaviors through environmental resources and constraints (social-structural level factors) and through psychological influences/mental resources (individual level factors).

Summary

HIV is a disease that has had devastating impacts globally. In the U.S., HIV is largely concentrated among the most socially disenfranchised groups, including those living in poverty. Individuals living in poverty, including those living with HIV, face a wide range of social and health disparities that result in a syndemic. To best address these disparities, we must consider the underlying structural and social causes, in particular, the resources that are available to these individuals and the impact this has on their health.

CHAPTER II: Food Insecurity and Medication Adherence Among People Living with HIV

Food insecurity can be construed as a marker of extreme socioeconomic marginalization. Food insecurity is “the limited availability of nutritionally adequate or safe food, or the inability to procure food in socially acceptable ways” (Weiser, Hatcher, et al., 2013, p. 91). The HIV/AIDS and food insecurity syndemic has largely been discussed in regards to sub-Saharan Africa (Himmelgreen, et al., 2009; Reddi, Powers, & Thyssen, 2012), however, it is a large issue within the United States as well. The United States Department of Agriculture (USDA) estimates that 14.3% of American households are food insecure (USDA Economic Research Service, 2013). Although there are no national statistics available on the prevalence of food insecurity among people living with HIV, individual studies have found rates ranging between 34% and 55% (Kalichman et al., 2014; Vogenthaler et al., 2010, Weiser et al., 2013).

Among people living with HIV, food insecurity is particularly detrimental because of these individuals’ already suppressed immune systems. Both malnutrition and HIV impact immune system functioning and when these two conditions co-occur the impact on the immune system is compounded and synergistic (Anabwani & Navario, 2005). Thus, not only do these two epidemics co-occur in the United States but there is also evidence that supports labeling it a syndemic (Singer, 2000). In addition to directly influencing physical health, food insecurity has also been associated with poorer health behaviors among people living with HIV, such as lower medication adherence and higher levels of sexual risk behavior (Anema, Vogenthaler, Frongillo, Kadiyala, & Weiser, 2009; Singer, Weiser, & McCoy, in press).

Food insecurity has been conceptualized and measured in a variety of ways, both in the HIV literature and by organizations such as the World Health Organization (WHO), the United

Nations (UN) Food Summit, the World Food Programme (WFP) and the United States Agency for International Development (USAID; Anema, Fielden, et al., 2013). Anema, Fielden, et al. (2013) suggest that common across many of these different definitions are three components of food security (i.e. sufficiency, quality, and safety) and these components vary across four dimensions (i.e. availability, access, utilization, and stability; Anema, Fielden, et al., 2013). Identifying and observing these components and dimensions is necessary in understanding the impact that food insecurity can have on a wide range of health factors and behaviors.

The relationship between food insecurity and health for people living with HIV is a complex one. Weiser and colleagues (2011) propose a bidirectional framework to explain how food insecurity may both increase chances of HIV transmission as well as exacerbate HIV morbidity and mortality. In this multilevel framework they identify three levels of influence. At the community level, there are structural factors that drive food insecurity, including ecological (e.g. drought, flooding), economic (e.g. poverty, access to education), and social factors (e.g. gender disempowerment, HIV-related stigma). At the household level, food insecurity impacts three possible types of pathways (i.e. nutritional, mental health, and behavioral) to both increase the risk of HIV acquisition as well as HIV morbidity and mortality at the individual level.

Although both directions of these pathways are interesting, of particular relevance to the current study are the specific pathways that influence viral suppression and CD4 (T-cell) counts which, in turn, impact morbidity and mortality (Weiser et al., 2011; See Appendix A for their diagram of pathways). The first path is the nutritional path, which includes macronutrient/micronutrient deficiencies, food and medication interactions, obesity and lipodystrophy (i.e. wasting). The second path is mental health, which includes overall mental health status, anxiety, depression and drug/alcohol use. The third and final path is behavioral,

which includes medication non-adherence, missed clinic visits, and treatment interruptions. In their conceptual model, Weiser et al. (2011) also propose that mental health paths may mediate the relationship between food insecurity and behavioral paths, including medication non-adherence. Although this conceptual framework was derived from the existing HIV literature, there have been a significant number of studies published since then that extend this framework to specific HIV positive populations and begin to elucidate some of the proposed mechanisms.

Food Insecurity and Morbidity and Mortality

The association between food insecurity and mortality is fairly consistent in the literature both in resource rich and resource poor countries. In British Columbia, Canada, Anema, Chan, et al. (2013) found that among HIV positive injection drug users, food insecurity was associated with mortality after controlling for age, income, when participants initiated ART, CD4 T-cell count and HIV RNA viral load. In rural Zambia, Birbeck et al. (2011) found similar results; food insecurity was associated with mortality when controlling for wealth, neuropsychiatric symptoms and WHO stage of HIV/AIDS. Consistent relationships are also evident between food insecurity and indicators of HIV morbidity (e.g. HIV RNA viral load, CD4 T-cell counts). Weiser et al. (2014) conducted a longitudinal study with 438 men and women living with HIV in Uganda. Food insecurity was associated with incomplete viral suppression (HIV RNA plasma levels) and having a CD4 T-cell count of less than 350 (Weiser et al., 2014).

This relationship has also been supported in resource rich countries. In a cross-sectional study of 671 men and women living with HIV in Atlanta, GA, Kalichman et al. (in press) found that food insecurity independently predicted self-reported unsuppressed HIV viral load. Kalichman and colleagues (2014) also found this relationship in a longitudinal 12-month cohort study of HIV positive alcohol drinkers; food insecurity was associated with unsuppressed HIV

RNA viral load obtained through chart abstraction. A similar pattern has also been found with illicit drug users in Canada. Anema et al. (2014) found that hunger was associated with lower odds of viral suppression (HIV RNA plasma levels) in bivariate analyses. However, when socio-demographics and adherence were controlled for, this association became non-significant. These findings highlight the importance of behavior when considering the relationship between food insecurity and physical health.

Food Insecurity and Medication Adherence

The relationship between food insecurity and antiretroviral (ARV) medication adherence for people living with HIV is a robust one in the literature. This direct relationship has been supported by data from resource poor and resource rich settings (Anema, Vogenthaler, Frongillo, Kadiyala, & Weiser, 2009; Singer, Weiser, & McCoy, in press). Additionally, multiple measures of medication adherence including unannounced pill counts (Kalichman et al., 2015), medication possession ratios (Hong et al., 2014) and self-report (e.g. VAS, Weiser et al., 2013) have been used as well as multiple measures of food insecurity including the Household Food Insecurity Access Scale (HFIAS; Coates, Swindale, & Bilinsky, 2007), the Radimer/Cornell scale (Kendall, Olson, & Frongillo, 1995; Radimer, Olson, & Campbell, 1990) and the United States Department of Agriculture Household Food Security Scale (Bickel, Nord, Price, Hamilton, & Cook, 2000). The majority of studies have used cross-sectional/correlational designs (Young, Wheeler, McCoy, & Weiser, 2014).

In a recent systematic review of studies reporting on the relationship between food insecurity and ARV adherence, nine out of thirteen studies that adjusted for other markers of poverty found statistically significant relationships such that greater food insecurity predicted lower ARV adherence (Singer, Weiser, & McCoy, 2014). In one of the few longitudinal studies

in this literature, Weiser and colleagues (2013) followed 284 unstably housed participants for a median of 22 months in San Francisco, CA. Weiser et al. (2013) found that food insecurity was associated with higher odds of medication non-adherence, having incomplete HIV viral suppression, and having a CD4 T-cell count of less than 200. Another study conducted by Peretti-Watel et al. (2006) used a representative sample of 1,809 HIV positive adults on ARVs in France. The researchers found that food privation (i.e. “whether or not a member of the household did not take any complete meal during a whole day due to lack of money, during the prior 4 weeks” pp. 2232) was associated with non-adherence among heterosexual men (Peretti-Watel, et al., 2006). From their review, Singer, Weiser & McCoy (*in press*) concluded that across many different environments (i.e. resource poor and resource rich countries) food insecurity is an important barrier to ARV adherence.

There have been several studies published since the review by Singer, Weiser and McCoy (*in press*), Hong et al. (2014) investigated the relationship between food insecurity and medication possession ratios using 390 adults living with HIV in Namibia, in which 67% were severely food insecure using HFIAS published cut-offs (Coates, Swindale, & Bilinsky, 2007). Hong et al. (2014) found that severe household food insecurity was significantly associated with a less than 80% medication possession ratio. Chen and Kalichman (*in press*) found that food insecurity was significantly associated with medication adherence measured by unannounced pill counts, even after controlling for socio-demographic characteristics as well as drug use in a sample from Atlanta, GA.

Recent qualitative studies have also found support for this relationship. Ndirangu and colleagues (2014) conducted ten focus group interviews in central Kenya with HIV positive participants in a food supplementation program. The researchers found that participants

perceived that receiving food assistance improved both their health and their ARV adherence. In a series of interviews with healthcare providers, McKinney, Modeste, Lee, Gleason, and Maynard-Tucker (2014) found that food insecurity was a significant perceived barrier for the healthcare providers' patients and that nutritional or food supplementation would be a key strategy for improving the ARV adherence of their patients. In sum, previous reviews and more recent literature support the relationship between food insecurity and ARV non-adherence across many populations and settings.

Potential Explanations of the Relationship Between Food Insecurity and ARV Adherence

There may be several reasons that food insecurity is independently related to medication adherence when controlling for other indicators of poverty. A large portion of ARV medications have food requirements in the prescribed dosing instructions, including nearly all protease inhibitors and several single tablet regimens (i.e. Complera, Stribild). These food requirements often state that medications should be taken with a meal, and some medications have specific caloric requirements (e.g. Edurant [a non-nucleoside reverse transcriptase inhibitor] must be taken with a meal of at least 400 calories). The reason behind these food requirements is often to maximize the absorption of these medications (Piacenti, 2006).

Individuals living with HIV who are food insecure may purposely not take these medications on days when they do not have food because they are partially following their drug prescription. They may also purposely choose not take their medications on days when they do not have food to avoid gastrointestinal side effects associated with taking these types of medications on an empty stomach. Kalichman and colleagues (2015) found that among a community sample of men and women living with HIV who experienced food insecurity in the past month, being on an ARV regimen that had food requirements was associated with poorer

ARV adherence and worse HIV RNA viral suppression, even when controlling for other markers of poverty (i.e. education, employment, income), medication side effects, and medication beliefs. Although this study cannot answer the question of why this may be (e.g. following prescriptions to take with a meal, to avoid side effects, etc.), it highlights that there may be something specific to these types of medications when considering the relationship between food insecurity and medication non-adherence.

Another potential reason for the direct, causal relationship between food insecurity and ARV medication adherence are competing resource demands. This reason has been proposed by Young, Wheeler, McCoy, & Weiser (2014) in their review of the literature and includes the necessity of making conscious trade-offs between buying food and paying for medications. When living in poverty, individuals are often faced with the decision of how to best allocate limited financial resources. Buying medications may be perceived as not as urgent as buying food for the day because, although ARV medications have been shown to prolong the lives of people living with HIV (Jansson, Wilson, Carr, Petoumenos, & Boyd, 2013), lacking food has more immediate consequences. Young, Wheeler, McCoy, and Weiser (2014) extend this idea of competing resource demands by also suggesting that individuals in these situations may even sell or trade their ARV medications in order to obtain food or other resources. When examining the reasons of non-adherence in a program that provided free or subsidized medications, Uzoichukwu et al. (2009) found that 28.2% of participants sold some of their medications to people that were unable to enroll in the studies because they needed the money for something else, including food.

Finally, there is some evidence that ARV medications may exacerbate hunger particularly during the initiation phase (Young, Wheeler, McCoy, & Weiser, 2014). In a qualitative study conducted in Botswana, Tanzania, and Uganda, Hardon et al. (2007) found that ARV users

commonly complained about the medications increasing their appetites and struggling with having insufficient money for enough food to satisfy their appetites. This study identified this exacerbation of hunger as a major barrier to consistent adherence to ARVs as well as a barrier to initiation of ART regimens (Hardon, et al., 2007). Other studies have found similar results (Senkomago, Guwatudde, Breda, & Khoshnood, 2011). Au and colleagues (2006) asked participants about their main barriers to adherence; 76% of their participants reported a fear of developing too big of an appetite on ARVs.

Of note is that these studies were all conducted in resource poor African countries. Although we would not expect there to be real differences in the biological drivers of appetite following the initiation of the same ARV regimen, differences may exist in the perception of hunger while on ARV medications between individuals living in resource poor versus resource rich countries. Additionally, levels of food insecurity prior to the initiation of ARVs, regardless of country resource status, are potentially a large driver in the actual increase in hunger.

Summary

Food insecurity has been shown to be a robust predictor of HIV morbidity, mortality and ARV adherence in a variety of resource environments. Food insecurity's direct impact on ARV adherence, specifically, has been shown even when controlling for other measures of poverty, such as income, education and homelessness. Researchers have proposed several explanations for this relationship including purposeful non-adherence, side effects, competing resource demands, and the exacerbation of hunger. Although the relationship between food insecurity and ARV adherence exists even when controlling for other markers of poverty, we must also consider this relationship within a syndemics of poverty framework. Food insecurity is common among those in poverty in addition to substance use and mental health issues. These

psychosocial factors could have synergistic effects on the relationship between food insecurity and ARV medication adherence.

CHAPTER III: Mediating and Moderating Factors of the Relationship Between Food Insecurity and Medication Adherence

The potential explanations for the causal relationship between food insecurity and ARV medication adherence outlined in the previous chapter largely focus on behavioral and, to an extent nutritional, explanations. However, a key component to Weiser et al. (2011)'s conceptual framework is the mediation of the relationship between food insecurity and medication adherence through mental health pathways, including depression, anxiety and drug/alcohol use. Although much of the theoretical syndemic literature (Singer, 2009) has discussed HIV syndemics of food insecurity, substance use, and mental health issues separately (i.e. syndemic of food insecurity and HIV, syndemic of substance use and HIV, syndemic of mental health issues and HIV), one could also argue that all of these epidemics are part of one large multi-faceted HIV syndemic. Although there is a dearth of research that explicitly tests the mediating or moderating role of the constructs of substance use and mental health issues on the relationship between food insecurity and medication adherence for people living with HIV, there has been some research looking at components of these relationships.

Food Insecurity and Substance/Alcohol Use

Food insecurity is fairly common among substance users. Vogenthaler et al. (2010) found that among HIV positive crack-cocaine users in Atlanta, GA and Miami, FL, 34% had experienced food insufficiency in the past 30 days. Similarly, among alcohol users in Atlanta, Kalichman et al. (2014) found that 43% of participants experienced food insecurity during at least one month of the 12-month study.

Weiser and colleagues (2011) suggest that substance use (including alcohol and other drug use) may mediate or moderate the relationship between food insecurity and ART adherence

and there is some support for this hypothesis in the HIV literature. Among a population of substance using HIV positive patients in South Florida, Surratt, O'Grady, Levi-Minzi and Kurtz (2015) found that food insecurity was associated with a greater likelihood of substance dependence as well as severe psychological distress. When these variables were controlled for in a multivariate analysis, the relationship between food insecurity and medication adherence remained significant. Similar results have also been found in resource poor countries. In South Africa, Morojele, Kekvaletswe, & Nkosi (2014) found that alcohol use was independently associated with ARV adherence when controlling for socioeconomic status, having a stable living situation and food insecurity.

However, there are also some inconsistent findings in the literature. Kalichman, Hernandez, et al. (in press) conducted a study in which participants were given a \$30 grocery store gift card and were asked to bring back their receipts. Kalichman et al. (in press) found that food insecurity was related to self-reported unsuppressed HIV viral load but that purchasing alcohol with the gift card did not moderate this relationship. Although Kalichman et al. (in press) did not find that purchasing alcohol was a moderator, the authors suggest that purchasing alcohol may not have been indicative of addiction, like purchasing tobacco products would be, and that future research should investigate objective measures of competing resources.

Food Insecurity and Mental Health

In addition to having significant impacts on physical health and well-being, food insecurity is also associated with a variety of mental health issues. In India, Heylen, Panicker, Chandy, Steward, and Ekstrand (in press) found that men and women living with HIV who had severe food insecurity had a significantly lower Quality of Life (QOL) score when adjusting for demographics and HIV-related stigma. They also found that for the men, food insecurity was

significantly related to higher depression scores using the Beck Depression Inventory (BDI), however, this was not the case for women (Heylen et al., in press). In Uganda, Palermo, Rawat, Weiser, and Kadiyala (2013) found that people living with HIV who were from severely food insecure household had lower mental health status scores using the mental health summary of the Medical Outcomes Study (MOS)-HIV Health Survey. Similarly, Tsai et al. (2012) found that food insecurity was associated with greater depressive symptoms for women living in Uganda who had initiated ARV regimens. Importantly, there was an interaction between food insecurity and social support such that social support buffered the relationship between food insecurity and depression. For men in this study, food insecurity was not associated with greater depression (Tsai, et al., 2012).

Mental health issues in the context of food insecurity and ARV adherence have also been studied in resource rich countries. Among a sample of HIV positive adults who drink alcohol in Atlanta, GA, Kalichman et al. (2014) found that individuals who experienced food insecurity were more likely to experience mental health issues including greater depression, having a greater number of life stressors, and were more likely to be hospitalized for psychiatric reasons. In San Francisco, CA, Weiser et al. (2009) found that higher odds of food insecurity among a sample of marginally housed HIV positive adults was independently associated with worse mental health as measured by the SF-36 (Riley et al., 2003). Similar to the effect found by Tsai et al. (2012) in Uganda, Kapulsky, Tang, and Forrester (in press) found that food insecurity was significantly associated with depression but social support acted as a buffer of this relationship among a sample of Hispanic adults in Boston, MA. In sum, food insecurity and a variety of mental health issues are related across resource poor and resource rich settings. However, lacking in the literature are explicit tests of the mediating role that mental health issues may play

in the relationship between food insecurity and ARV medication adherence as proposed by Weiser et al. (2011).

Distance from Resources

Although Weiser and colleagues (2011) do not propose it, there are also structural factors that may moderate the relationship between food insecurity and ARV adherence. Geography has been found to be a significant factor in health and well-being (Drummer, 2008; Fleuret & Atkinson, 2007, Nunn et al., 2014). Individuals living in poverty have a variety of competing demands and a lack of resources to meet all of those demands. For instance, an individual may have only enough bus fare to go to one location. This individual must have to choose between going to the pharmacy, going to the grocery store or going to their doctor. However, if some of these resources are closer and thus easier to get to such as on foot, this individual may be able to meet more of their competing demands.

There have been a few studies within the food insecurity and HIV adherence literature that have looked at the impact of distance. Morojele, Kekwaletswe, and Nkosi (2014) conducted a study in South Africa that examined the impact of a range of structural, psychosocial and substance use factors on medication adherence for people living with HIV. In addition to food insecurity significantly predicting ARV non-adherence, the time it took for participants to get to their doctor also predicted suboptimal adherence.

There is also a study that looks at geospatial distance from city-center as a moderator of the relationship between food insecurity and medication adherence over an 8-month time frame (Kalichman, Pellowski, et al., 2011). Kalichman et al. (2011) used geocoding to determine a point-to-point distance from participants' home addresses to Atlanta's city center as well as the

nearest city mass transportation stops (train or bus), nearest supermarket, nearest convenience food store and the pharmacy from which the participants received their HIV medications from. Kalichman et al. (2011) found that distance from city center moderated the relationship between food insecurity and medication adherence, such that individuals who lived further than five miles from city center and who were food insecure had the worst adherence over eight months. The authors propose that this moderation may have occurred because of several intersecting factors such as lack of transportation, social isolation, and difficulty accessing resources that are more often available in urban areas (Kalichman et al., 2011).

Discussions of geographical influence are particularly important when discussing issues of poverty and health. Individuals living in poverty are more likely to have trouble with transportation and this may impact their abilities to obtain their medications and attend regular doctor's visits (Lankowski, Siedner, Bangsberg, & Tsai, 2014). Lack of transportation is also a consistent barrier to care for people living with HIV in rural areas (Pellowski, 2013). Thus, living further away from potential resources and living in poverty may have a significant impact on the health of people living with HIV as well as their health behaviors such as medication adherence.

Summary

A common thread in the reviews that have been conducted on the food insecurity and ARV adherence (Anema, Vogenthaler, Frongillo, Kadiyala, & Weiser, 2009; Singer, Weiser, & McCoy, in press; Young Wheeler, McCoy, & Weiser, 2014) is the necessity for more longitudinal studies in both resource rich and resource poor countries. Of particular interest are longitudinal studies that can elucidate the mechanisms through which food insecurity impacts medication adherence and subsequent HIV morbidities and mortality (Weiser et al., 2011). There is some evidence already in the literature regarding the mediating or moderating role that a

number of variables may play, including depression, social support, alcohol/drug use and distances to resources. However, further studies are needed to clarify how these variables may interact in combination with one another.

Chapter IV: The Current Study and Hypotheses

The work discussed thus far highlights the relationships between social context, social position, and behavior. More specifically, limited access to resources based on social position can significantly impact health behaviors (Johnson et al., 2010). Previous research on food insecurity and HIV has focused on establishing the relationship between food insecurity and health behaviors, both for people at-risk for HIV infection and those that already have HIV (Anema, Vogenthaler, Frongillo, Kadiyala, & Weiser, 2009; Singer, Weiser, & McCoy, *in press*; Steenkamp, Venter, Walsh, & Dana, 2014). For people living with HIV, the relationship between food insecurity and ARV medication adherence has been shown in a variety of social contexts (i.e. resource poor and resource rich environments; Singer, Weiser, & McCoy, *in press*). However, one main caveat of these studies is the level of analysis. The majority of the studies that have been conducted thus far use cross-sectional analyses to determine an association between food insecurity and ARV medication adherence (Young, Wheeler, McCoy, & Weiser, 2014). There have been a few longitudinal studies that establish a directional relationship between food insecurity and medication adherence (Chen & Kalichman, *in press*; Weiser et al., 2014), however, these studies also have limited explanatory power because they still concentrate on the individual level of analysis. Specifically, they do not allow for a true test of whether medication non-adherence occurs on days with limited access to food.

There have been no studies, to my knowledge, that look at the relationship between food insecurity and ARV medication adherence on a daily level. This is particularly important given the rationales that are used to explain this relationship. Nearly all of the potential explanations in the literature (Chapter II) require a daily relationship between food insecurity and ARV

medication adherence to exist, however, this has not yet been established. The current study seeks to confirm the assumption that the relationship between food insecurity and ARV non-adherence occurs on a daily level.

Daily diary methods have been used to study a variety of emotions, cognitions, health symptoms, and health behaviors (Affleck, Zautra, Tennen, & Armeli, 1999; Tennen, Affleck, Armeli, & Carney, 2000). Daily diary methods allow for relatively easy repeated measures of experiences and behaviors that fluctuate within short time spans and they greatly reduce recall bias in the reporting of these experiences (Bolger, Davis, & Rafaeli, 2003). Because the purpose of this study was to estimate the association of events that occurred within the individual (food insecurity and missed doses of medication on a given day), the number of assessments (days) within the individual had to be large rather than focusing on a large individual sample size (Iida, Shrout, Laurenceau, & Bolger, 2012). Multilevel models are the most appropriate analytic technique for analyzing daily diary data given the nested structure of the data, with days nested within individuals (Schwartz & Stone, 1998).

One key concern about daily measurement is the possibility of reactivity to the measurement, such that completing the surveys becomes habitual to participants leading to inaccurate reporting of behaviors. In several coping with pain and depression studies, linear trends have been found in the data, however, individual directionality has been mixed such that some participants report less pain or depression as they are monitored and some participants report more (Affleck, Tennen, Urrows, & Higgins, 1991; Affleck, Zautra, Tennen & Armeli, 1999). Authors caution this may be a reactivity to the measurement but also offer up the alternative explanation that daily measurement alters some individuals' coping methods particularly in the case of ignoring a problem as a form of coping (Affleck, Tennen, Urrows, &

Higgins, 1991). In the current study, we predicted that daily measurement would not alter the reporting because of the nature of the variables (i.e. food insecurity is hard to change for those living in poverty), however, there is still the possibility of habituation to the measurement, leading to inaccurate reporting of behaviors and experiences. Thus, prior to hypothesis testing, reactivity to the daily measurement was tested and time was controlled for in all multilevel models.

All of the hypotheses for the current study were tested twice, first at the individual level (Chapter VII) with the daily data aggregated across time to replicate findings already in the literature and then, second, at the day level (Chapter VIII) to extend the literature and utilize the full multilevel structure of the data collected in this 45-day observational study. The first hypothesis concerns the basic relationship between food insecurity and medication adherence.

Hypothesis 1: The experience of food insecurity will predict ARV medication non-adherence.

After the direct relationship between food insecurity and medication adherence was established, moderators and mediators of this relationship were tested. There is evidence, at the individual level, that alcohol use moderates the relationship between food insecurity and ARV medication adherence (Chen & Kalichman, *in press*). Likewise, one of the most robust predictors of daily adherence is daily alcohol use (Parsons, Rosof, & Mustanski, 2008). Thus, alcohol use was tested as a moderator using three different measures of alcohol use.

Hypothesis 2: Alcohol use will moderate the relationship between food insecurity and medication adherence such that those that drink alcohol and experience food insecurity will have the lowest medication adherence.

Hypothesis 2a: *Drinking alcohol (yes/no) will strengthen the relationship between high food insecurity and lower medication adherence.*

Hypothesis 2b: *Drinking a greater number of drinks in a day will strengthen the relationship between high food insecurity and lower medication adherence.*

Hypothesis 2c: *Higher estimated blood alcohol concentrations will strengthen the relationship between high food insecurity and lower medication adherence.*

Weiser et al. (2011) proposed that there are several psychosocial factors that will mediate the relationship between food insecurity and medication adherence. To extend these propositions and to apply them to a theoretical framework, the Reserve Capacity Model (Gallo & Matthews, 2003; See Appendix A for their diagram of pathways) was tested as a mediator. The Reserve Capacity Model is a model of stress that seeks to explain the health disparities that exist among those with low socioeconomic status. Deficient psychosocial resources (e.g. low sense of self-control, low self-esteem, pessimism, low social support) are theoretically proposed to mediate the relationship between SES and health (Gallo, de Lose Monteros, & Shivpuri, 2009). Previous empirical research has shown the construct of reserve capacity to fully mediate the relationship between SES and metabolic syndrome in women (Matthews, R  ikk  nen, Gallo, & Kuller, 2008) and to partially mediate the relationship between perceived discrimination among Hispanic Americans and health-related quality of life (Howarter & Bennett, 2013). This construct, however, has not yet been tested among people living with HIV.

Hypothesis 3: The components of the Reserve Capacity Model (Gallo & Matthews, 2003) will mediate the relationship between food insecurity and medication adherence.

Hypothesis 3a: *The relationship between food insecurity and medication adherence will be mediated by stressful experiences.*

Hypothesis 3b: *The relationship between food insecurity and medication adherence will be mediated by reserve capacity (a bank of tangible, interpersonal, and intrapersonal resources).*

Hypothesis 3c: *The relationship between food insecurity and medication adherence will be mediated by emotions with positive valence.*

Hypothesis 3d: *The relationship between food insecurity and medication adherence will be simultaneously mediated by stressful experiences, reserve capacity, and emotions (full structural model).*

The final factors that will be tested as moderators of the relationship between food insecurity and medication adherence are geographical distances to resources. There is evidence in the literature that the distance to resources is a significant moderator of the relationship between food insecurity and medication adherence on level of the individual. Kalichman et al. (2011) found that those that lived further from city center and were hungry had the lowest ARV medication adherence over eight months. This study will attempt to replicate these findings on the daily level.

Hypothesis 4: Distance from resources will moderate the relationship between food insecurity and medication adherence such that those living further from resources and experiencing food insecurity will have the lowest medication adherence.

Hypothesis 4a: *Living farther from city center will strengthen the relationship between food insecurity and medication adherence.*

Hypothesis 4b: *Living farther from the nearest supermarket will strengthen the relationship between food insecurity and medication adherence.*

Hypothesis 4c: *Living farther from the nearest bus stop/train stop will strengthen the relationship between food insecurity and medication adherence after controlling for difficulties with transportation.*

Hypothesis 4d: *Living farther from the participant's pharmacy will strengthen the relationship between food insecurity and medication adherence.*

Chapter V: Methods

Overview of Study Design

The current study examined the daily relationship of food insecurity and medication non-adherence for people living with HIV. Behavioral, psychosocial and structural factors were tested as potential mediators and moderators of this relationship. To accomplish this, the current study employed an observational cohort design the included 45-days of daily text message surveys and medication monitoring as well as two audio-computer assisted self-interviews (ACASIs), one prior to the daily diary part of the study and one after its completion. Finally, participants provided a chart-abstracted CD4 T cell count and HIV RNA viral load. Participants were compensated for all completed study activities and the University of Connecticut Institutional Review Board approved the study protocol.

Population and recruitment

Study participants consisted of men and women living with HIV/AIDS in and around Atlanta, GA, an area with a substantial and established HIV epidemic. According to the CDC, Georgia has the fifth highest number of individuals living with HIV of states in the U.S. and Atlanta has the seventh highest number of new diagnoses for metropolitan areas with populations greater than 500,000 (CDC, 2013). There are over 50,000 people living with HIV/AIDS in Georgia and 64% of those individuals live in the Atlanta area (Georgia Department of Public Health, 2012). The HIV epidemic in Atlanta is occurring largely among African-Americans (CDC, 2013)

This study focused specifically on food insecurity, medication adherence and mediating/moderating factors of this relationship, such as alcohol use, among people living with HIV. Eligibility criteria included (a) being 18 or older, (b) name-matching proof of positive HIV

status and photo identification, (c) currently taking antiretroviral medications (ARVs), (d) self-reported missing at least one dose of medication in the past month, (e) self-reported food insecurity within the past month, (f) self-reported consumption of at least one alcoholic beverage within the past month, and (g) willingness to use a Wisepill device for medication management.

Recruitment and Screening

Our project site relies heavily on word of mouth to recruit its participants. New participants contact the project site often and former participants call regularly inquiring about new study opportunities. There was no active recruitment specifically for this study and any active recruitment that did occur was at the project level, although the study may have benefitted from such recruitment.

Potential participants called the study site directly to be screened. Interested persons were asked several questions to assess their eligibility for the study and these questions were embedded within a set of foil questions to mask the true purpose of the study (See Appendix B for the screening instrument). If the participant was deemed eligible based on their answers to the screening questions, the screener gave the participant an enrollment appointment to come into our community-based research site located in midtown Atlanta, Georgia.

Enrollment Session

During the enrollment session, participants first completed informed consent (Appendix C) with the assessor. After the participants were consented to the study, locator information was collected including phone numbers, their home address and the contact information of a family member or friend that can be contacted if the research staff is unable to reach the participant. Participants were also asked to step on a scale to obtain their body weight. At this point, participants were instructed on how to complete the baseline ACASI (see below for specific

information about the assessment). After the participants completed the baseline ACASI, the assessor instructed them on how to complete the daily text message surveys. A project cell phone was given to each participant to complete the daily text message surveys on. The assessor answered any questions that the participant had about the text message survey and all participants completed a practice survey in office with the assessor to insure that there were no problems. Participants were paid \$2 for each completed daily text survey, for a potential total of \$90.

Finally, the assessor explained the Wisepill device. The Wisepill device is an electronic pillbox that, when opened, sends a cellular signal to a central server. This time and date stamped information is then accessible via hosted website by the research staff (For further information about the Wisepill device and the research that has been conducted using this device, see Appendix D). The participants were instructed to use this device to hold their medication for the entirety of the study and to refill it themselves as needed. Using a decision tree, the assessor selected which ARV medication the participant was to put in the Wisepill device (see Appendix E for the decision tree). Upon completing the 45-day study, participants returned the Wisepill device and completed a follow-up ACASI which contained the same questions as the baseline ACASI.

Height and Weight

During the enrollment session, participants were asked to step on a Tanita TBF-215 model scale, which is used to measure body weight, height, body mass index (BMI) as well as percentage body fat by bioelectrical impedance analysis (BIA). This scale requires participants to step on it in their bare feet. Participants with any internal medical devices, such as a defibrillator,

were not asked to step on this scale to avoid complications and were instead weighed on a standard bathroom scale.

ACASI

Basic demographic information was collected including gender identity, race/ethnicity, sexual orientation, education, employment, estimated personal yearly income, and age.

Descriptive measures of general health, such as hospitalizations and medication beliefs, as well as psychosocial factors, such as depression, were assessed. Finally, several scales that address components of the reserve capacity model, including reserve capacity, stressful life events and negative and positive emotions (Gallo, Bogart, Vranceanu & Matthews, 2005; Gallo & Matthews, 2003), were assessed at baseline and follow-up with items presented individually but in the order of the scales. See Appendix F for Full ACASI Assessment).

General health. Participants were asked how many times they had to be hospitalized because of their HIV in their lifetime. Responses ranged from 0 to 5+ times. Participants were also asked about their medication adherence, the visual analog scale (VAS) was used to assess self-reported baseline medication adherence (Giorano, Guzman, Clark, Charlebois, & Bangsberg, 2004). The VAS consists of a horizontal number line that ranges from 0%-100%. Participants are then asked to indicate on the line what percent of their HIV medication they have taken in the past six weeks. As a measure of self-reported medication adherence, the VAS has been shown to be a fairly robust measure that significantly correlates with more objective measures of adherence (i.e. unannounced pill counts) as well as HIV RNA viral load (Finitsis, Pellowski, Huedo-Medina, Fox & Kalichman, under review).

Participants' beliefs about their medications were also assessed using the Beliefs About Medicines Questionnaire (Horne et al., 2004, 2007). The medication necessity subscale consists

of five items including “My health, at present, depends on my HIV medications.” The medication concerns subscale also consists of five items includes “I sometimes worry about long-term effects of my HIV medications.” All items are responded to on a 5-point scale, 1 = *Strongly Agree*, 5 = *Strongly disagree*. Both scales were internally consistent (medication necessity scale Cronbach’s $\alpha = 0.80$, medication concerns scale Cronbach’s $\alpha = 0.75$).

Psychosocial factors. In addition to general health, medication adherence and beliefs, participants were also asked about several psychosocial factors.

Alcohol use. To assess each participant’s level of alcohol use, the Alcohol Use Disorders Identification Test (AUDIT) was used (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The AUDIT assesses alcohol consumption, alcohol dependence and alcohol-related problems. A score of 8 or above indicates potentially hazardous drinking levels (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). This scale demonstrated acceptable reliability in this sample (Cronbach’s $\alpha = 0.79$).

Food insecurity. Baseline food insecurity was assessed using 7-items from the USDA Household Food Security Scale (Bickel, Nord, Price, Hamilton, & Cook, 2000). Participants were asked whether or not each items was true for them, 0 = No, this is not true for me, 1 = Yes, this is true for me. Sample items are “In the past 6 weeks, the food that I bought just did not last and I did not have money to get more” and “In the past 6 weeks, I ate less than I felt I should because there was not enough money for food.” This scale demonstrated good reliability (Cronbach’s $\alpha = 0.89$).

The reserve capacity. Using a method by Gallo, Bogart, Vranceanu & Matthews (2005), reserve capacity was calculated as the sum of perceived control, self-esteem, and social support

minus the sum of pessimism and social conflict. All scales were standardized prior to calculating the reserve capacity such that the mean was set to 0 with a standard deviation of 1.

Perceived control. Pearlin and Schooler's (1978) Personal Mastery Scale was used to assess levels of perceived control. Responses were on a 5-point Likert scale, *1 = Strongly Agree*, *2 = Agree*, *3 = Uncertain*, *4 = Disagree*, *5 = Strongly Disagree*, and responses were scored so that higher scores indicate higher levels of perceived control. Sample items are "I have little control over the things that happen to me" and "I often feel helpless in dealing with the problems of life." This scale demonstrated good reliability for this sample (Cronbach's $\alpha = 0.83$).

Self-esteem. The 10-item version of Rosenberg's Self-Esteem Scale (Rosenberg, 1965) was used to assess levels of self-esteem. Responses were on a 5 point Likert scale, *1 = Strongly Agree* to *5 = Strongly Disagree*, and responses were scored so that higher scores indicated higher levels of self-esteem. Samples items are "I feel that I have a number of good qualities" and "On the whole, I am satisfied with myself." This scale demonstrated good reliability in this sample (Cronbach's $\alpha = 0.86$).

Social support. Level of social support was assessed through a 10-item scale of tangible, emotional, and informational support (adapted from Brock, Sarason, Sarason, & Pierce, 1996). Responses were *1 = completely true*, *2 mostly true*, *3 = mostly false* and *4 = completely false*. Possible scores ranged from 10-40, responses were scored so that higher scores indicated more social support. Sample items are "There are several people that I trust to help me solve problems" and "If I needed a place to stay for a week because of an emergency, I could easily find someone who would put me up." This scale demonstrated good reliability in this sample (Cronbach's $\alpha = 0.88$).

Pessimism. Scheier, Carver & Bridges's (1994) Life Orientation Test-Revised was used to evaluate levels of pessimism. Responses were on a 5-point Likert scale, *1 = Strongly Agree* to *5 = Strongly Disagree*, and responses were scored so that higher scores indicated more pessimism. Sample items are "I hardly expect things to go my way" and "I rarely count on good things happening to me." This scale demonstrated fair reliability in this sample (Cronbach's $\alpha = 0.71$).

Social conflict. The first 12 items of Lakey, Tardiff and Drew's (1994) Inventory of Negative Social Interactions was used to assess levels of social conflict. Participants were asked to report how often in the past six weeks, he/she experienced each stressful social situation. Items included "someone yelled at you" and "someone told negative things about you to another person." Responses were, *0 = Not at all*, *1 = Once or twice*, *2 = About once a week*, *3 = Several times a week*, *4 = About every day*. This scale demonstrated very good reliability in this sample (Cronbach's $\alpha = 0.93$).

Stressful experiences. To assess stressful experiences, participants completed 17-items focusing on events that occurred in the past six weeks (adapted from Leserman et al., 1999). Participants indicated whether or not each specific event had occurred, *0 = No*, *1 = Yes*. Sample items are "In the past 6 weeks, have you had a serious illness?" and "In the past 6 weeks, did you disclose your HIV status to a friend?" This scale demonstrated fair reliability in this sample (Cronbach's $\alpha = 0.77$).

Emotional valence. Kamarch et al.'s (1998) Diary of Ambulatory Behavioral States was adapted to assess emotion states over the past six weeks. Sample items are "In the past six weeks, how often have you felt excited?" and "In the past six weeks how often have you felt angry?" Responses were, *0 = Never*, *1 = Sometimes*, *2 = Often*, *3 = Very Often*. Negative

emotions were reverse coded and the scale demonstrated fair reliability in this sample (Cronbach's $\alpha = 0.74$).

Chart Abstracted HIV RNA Viral Load and CD4 T Cell Count

Participants were asked to obtain a copy of their latest viral load and CD4 cell counts from their health care provider and these records could be no older than 3 months. These records has to be marked with a clinic stamp to verify it's authenticity. Health care providers and blood assays use several cut-offs to determine undetectable viral load. For consistency across viral load chart values, we defined undetectable viral load as <50 copies/mL.

Daily Data

The same text message survey was sent to all participants every day for 45 days. The questions referred to the previous day's activities. This type of daily measurement has been used to assess a wide variety of health behaviors and cognitions including sexual risk behaviors, depression, coping skills, and alcohol consumption (Barta et al. 2008; Gallo, Bogart, Vranceanu & Matthews, 2005; Tennen, Affleck, Armeli & Carney, 2000). This approach has been successfully used with individuals with low socioeconomic status as well as people living with HIV specifically (Barta et al. 2008; Gallo, Bogart, Vranceanu & Matthews, 2005). Forty-five days was chosen for the time frame for several reasons. First, the purpose of this study was to estimate the association of day level events. This required the number of assessments (days) within the individual to be large rather than focusing on a large individual sample size (Iida, Shrout, Laurenceau, & Bolger, 2012). The second reason was do to the food insecurity variable. Individuals living in poverty who rely on government or state assistance receive financial resources (i.e. food stamps, Social Security benefits) once or perhaps twice a month. One can assume compared to the days leading up to that payment, individual may experience more food

insecurity than the days following that payment. Because this payment often happens only once a month, I wanted to follow participants for a frame of time that would encapsulate more than just a month to observe food insecurity both prior to that payment and afterwards.

Food insecurity. To assess daily food insecurity, participants answered three questions adapted from the USDA Household Food Security Scale (Bickel et al., 2000). These items are answered with a yes or a no response and are as follows: “I worried about my food running out yesterday,” “I ate less than I needed to yesterday,” “I was hungry, but could not eat because I couldn’t afford food yesterday.”

Alcohol use. To assess alcohol, participants answered four questions. The first was “How many alcohol drinks did you have yesterday? If you did not drink say 0.” Participants were then asked what type of alcohol they drank yesterday. Finally, participants were asked about what time they had their first drink and what time they had their last drink. The time information was used to look at estimated blood alcohol concentrations (eBACs) using the formula validated by Hustad and Carey (2005). The equation is as follows $BAC = [(c/2)*(GC/w)] - (.02*t)$; where c = total standard drinks consumed, GC = gender constant (9.0 for women, 7.5 for men), w = weight in pounds, and t = total hours spent drinking (Matthews & Miller, 1979). A standard drink is defined as 12 fluid ounces of beer, 5 fluid ounces of wine, or 1.5 fluid ounces of hard alcohol/spirits (National Institute on Alcohol Abuse and Alcoholism, 2015) and participants were trained in how to estimate the number of standard drinks they consumed in a day.

Medication adherence. Daily medication adherence data was collected using the Wisepill device (See Appendix D for a more thorough discussion of the Wisepill). When a participant opens the Wisepill device to take their medication, a date and time stamp is created which is then sent to a central server via general packet radio service (GPRS). This information

is then accessible via a secure, internet-based interface. This data was downloaded from the website and compared to each participant's dosing schedule and coded dichotomously for missed doses. For example, if a participant opens their Wisepill device on a day only once but is prescribed to take his medications twice a day the day will be coded as a missed day.

Wisepill signal lapses of 48 hours or greater were investigated by a phone call to the participant to determine whether the lapse was due to a technical failure (battery failure, loss of cellular signal) or if it was due to a behavioral cause (pocket dose, missed dose; Bachman DeSilva et al., 2013). An adjusted adherence that factored in reported pocket doses was calculated (Haberer et al., 2011).

Financial Assessment

At the follow-up appointment, participants completed a financial assessment with a trained staff member (See Appendix G for the daily financial assessment). Participants were asked about where they received financial resources from, the amount of money, and when they received that payment for the past 45 days (the exact days of the daily data collection). Participants were asked about jobs (full time/part time/side work), short-term disability, Social Security, unemployment assistance, food stamps, and any other types of monetary assistance that they received.

Geocoding

Procedures adapted from spatial analysis in epidemiology were used to examine the geographical distribution of hunger and medication adherence (Kalichman et al., 2011; Schleihau, Watkins & Plant, 2009). Participants' home addresses were entered into *Google Earth*, a global positioning application. Using these coordinates, the distances between participants' home addresses and basic services and resources was measured. This included city

mass transportation stops (train or bus), nearest supermarket, and the pharmacy from which they receive their ARV medications. Finally, the distance to city center was measured. Previous research (Kalichman et al., 2011) dichotomized this distance to within a 5-mile radius of city center and outside this radius. This research found an interaction between food insecurity and living outside of city center such that participants who lived outside the city and who were also hungry had the lowest medication adherence.

Statistical Analyses

First, all variables were examined for normality and, if needed, were transformed. To characterize the sample, basic means and frequencies were conducted using the demographic information collected at baseline. All of the hypotheses for the current study were tested twice, first at the individual level (Chapter VII) with the daily data aggregated across time to replicate findings already in the literature and then, second, at the day level (Chapter VIII) to extend the literature and utilize the full multilevel structure of the data.

Most of the analyses were conducted using R version 3.1.3. (R Core Team, 2015) using the library “lme4: Linear mixed-effects models using Eigen and S4” (version 1.7; Bates et al., 2014). Mediation analyses were conducted using “mediation” package (version 4.4.2; Tingley, Yamamoto, Hirose, & Keele, 2014; Tingley, Yamamoto, Hirose, Keele, & Imai, 2014). The individual level structural equation model testing the simultaneous mediations of the Reserve Capacity Model (Gallo & Matthews, 2003) was conducted using AMOS (Arbuckle, 2006). Finally, the multilevel structural equation model testing the simultaneous mediations using day-level data was conducted using MPlus (Multhén & Multhén, 2014).

In the current study, adherence is treated as a dichotomous outcome with 1 meaning that every dose was taken for that day and 0 indicating at least one dose was missed the day and were

modeled using binomial regression (Merlo et al., 2006). Because both the food insecurity and alcohol questions refer to the prior days experiences whereas the Wisepill data is reported for the current day, the data was restructured so that this information all referred to the same day. In its simplest form, the model predicts the medication adherence on a based upon the predictor variables included in the regression equation. B estimates and standard errors were reported for model estimates. For bootstrapped direct and casual mediation effects, confidence intervals were also be reported. For the multi-level models fixed and random effects were used. The intercepts and slopes of the models were modeled first as random effects. If the residual variances for the slopes are determined to not vary across Level 2 units, they will be converted to fixed effects (Snijders & Bosker, 1999; For multilevel modeling formulas see Appendix H).

Missing data were handled using multiple imputation by chained equations using all variables in the dataset to estimate missing data (van Buuren & Groothuis-Oudshoorn, 2011). Predictive mean matching, a semi-parametric imputation method was used in order to preserve any non-linear relationships present in the data (van Buuren & Groothuis-Oudshoorn, 2011). The R package “mice: Multivariate Imputation by Chained Equations” version 2.22 was to perform these statistics (van Buuren & Groothuis-Oudshoorn, 2014).

The term “event record” describes a text message survey for a single day and contains information about food insecurity and alcohol use, as well as the daily adherence data. All of the day level analyses will employ a multi-level framework such that event records are treated as a statistical unit of analysis (or “level 1 unit”), nested within a participant (or “level 2 unit”; Luke, 2004; Walls & Schafer, 2006). Prior to day-level hypothesis testing, the impact of time was examined to determine whether there was any indication of reactivity to the daily measurement. If habituation or sensitization effects occur over the course of the study, we would expect to

observe a significant upward or downward linear trend in the rates at which missed doses of medication occur. To test this, time (day in study) was entered as a single predictor of medication adherence.

Hypothesis testing. To test hypothesis 1, I created a simple regression of food insecurity predicting medication adherence.

Hypothesis 2: Alcohol use will moderate the relationship between food insecurity and medication adherence such that those that drink alcohol and experience food insecurity will have the lowest medication adherence.

To test hypothesis 2 and its sub-hypotheses (2a-2c), I regressed food insecurity, drinking and the interaction between food insecurity and drinking onto medication adherence. This was repeated using drinking alcohol (yes/no; Hypothesis 2a), number of alcoholic beverages (Hypothesis 2b), and estimated blood alcohol concentration (Hypothesis 2c).

Hypothesis 3: The components of the Reserve Capacity Model (Gallo & Matthews, 2003) will mediate the relationship between food insecurity and medication adherence.

To test hypothesis 3 and its sub-hypotheses (3a-3d), The individual-level constructs of the Reserve Capacity Model (i.e. stressful experiences, reserve capacity, cognitive-emotional factors) were each entered separately into the food insecurity/medication adherence regression model as mediators and the direct and indirect effects of each of the mediations were calculated and evaluated for significance. Finally, the full multiple mediation model was tested with all three psychological constructs and their relationships to each other estimated using AMOS (Arbuckle, 2006) for the individual level data and Mplus (Multhén & Multhén, 2014) for the multilevel structural equation model with daily data.

Hypothesis 4: Distance from resources will moderate the relationship between food insecurity and medication adherence such that those living farther from resources and experiencing food insecurity will have the lowest medication adherence.

To test hypothesis 4 and its sub-hypotheses (4a-4d), I regressed food insecurity, distance and the interaction between food insecurity and distance onto medication adherence on the daily level. This was repeated using distance from city center (Hypothesis 4a), distance from nearest supermarket (Hypothesis 4b), distance from nearest bus/train stop (Hypothesis 4c), and distance from participant's pharmacy (Hypothesis 4d).

CHAPTER VI:

Results – Part 1: Demographics

For this study, 573 HIV positive individuals were screened for eligibility and a total of 503 were deemed not eligible for the study (See Figure 1). The majority of participants (N=260) screened out because they did not meet multiple eligibility criteria. Of the three major criteria for entry into the study, 112 individuals did not report severe food insecurity in the previous month (i.e. hunger and unable to buy more food), 49 individuals did not report drinking alcohol in the past month, and 39 individuals were not currently taking antiretroviral medications at the time of screening.

There were 70 individuals who met all eligibility criteria for entry into the present study and they were scheduled for an in-office enrollment appointment. Of these individuals, 11 did not show for their scheduled appointment or were deemed ineligible at the time of enrollment due to old medications or having their medications prescribed to them in blister packs. Blister packs are pre-packaged doses of medications and they do not fit into the Wisepill device for medication monitoring. A total of 59 individuals enrolled into the 45-day observational study and 57 individuals completed the study; two individuals did not complete their follow-up assessment.

Demographic Characteristics

The majority of the 59 participants enrolled in the current study were male (N=40; 67.8%; See Table 1). There were also 12 females (20.3%) and seven transgender individuals (11.9%). Almost the entire sample identified as African American/Black (96.6%). One person was White (1.7%) and one person identified as Hispanic/Latino (1.7%). There was good variability in the sexual orientation of this sample; approximately 47.5% of the sample identified

as gay or homosexual, 16.9% identified as bisexual and 35.6% identified their sexual orientation as heterosexual.

This sample was fairly well educated, with 44.1% of participants completing some education after high school. An additional 35.6% had completed high school or their GED. One in five (20.3%) participants had less than a high school education. Income over the course of the 45-day study was assessed. A majority of participants (78.9%) received disability benefits (i.e. short-term disability, Social Security Disability Insurance [SSDI]) during the study averaging \$1268 during the 45 days. Nine participants received payment for a job (part-time/full-time) averaging \$1814 during the 45 days. Of note, 61% of the sample received food stamps during the course of the study. On average, participants had an income of \$1,472.66 for the 45 days, which, if consistent, would amount to a yearly income of approximately \$11,944. Finally, the sample was overall middle-aged with an average age of 48 (SD=6.62; range = 30-59).

Physical health status. In addition to basic demographic characteristics, information was also obtained on the participants' physical health status (See Table 2). The distribution of participants' BMIs somewhat matched that of the general U.S. adult population (Flegal, Carroll, Kit, & Ogden, 2012); 37.3% of participants were in the normal range, 37.3% would be categorized as overweight, and 25.4% of the participants in this study were obese. Participants were asked to bring in a chart-abstracted HIV RNA viral load and a CD4 T-cell count. The majority of participants had undetectable viral loads (81.1%). Participants also had relatively high CD4 T-cell counts, with only six having a CD4 T-cell count of 200 or less, the cut-off for an AIDS diagnosis. More than half (61%) of participants were on regimens that required taking their prescriptions with food. The majority of participants (55.9%) reported having spent time in the hospital for their HIV at some point in their lives.

In general, participants self-reported sub-optimal medication adherence based on the visual analog scale; the average on this scale was 84.54 (SD = 18.62). Participants did report high levels of believing that medications are necessary to remain healthy (M=22.56 out of a possible 25, SD=2.83). Participants, however, did report some concerns about their medications (M=13.29 out of a possible 25, SD=4.33).

Psychosocial baseline characteristics. In addition to physical health characteristics, baseline information was also obtained on psychosocial factors (See Table 3). The average score on the AUDIT was 5.81 (SD=5.72) and 16 participants (27.1%) scored at or above the cut-off of 8 indicating potentially hazardous drinking levels. Four of those participants (6.8%) scored at or above the cut-off of 16 indicating serious drinking problems (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Consistent with the screening criteria, participants responded yes to 2.78 indicators of food insecurity in the six weeks.

At baseline, participants had high levels of depression; the average on the 12-item CES-D was 12.63 (SD=7.52). Participants also reported moderate levels of personal mastery (M=26.98, SD= 5.58). For the measure of self-esteem, participants reported relatively high levels (SD=39.44, SD=6.69). Participants also had fairly high levels of social support (M=29.66, SD=6.71). They also reported moderate levels of pessimism (M=23.64, SD=5.77). Participants reported low levels of social stress, however, there was considerable variability across participants (M= 11.90, SD=10.68). Participants, on average, experienced 3.85 life stressors in the six weeks before the baseline assessment.

Day-Level Behavior

Of the 2,655 days of collected data, there were 530 days (20.0%) where doses of medication were missed (See Table 4). Over the course of the study, participants' average

adherence was 83.27%. Participants reported one or more indicators of food insecurity on 718 days (27.0%). Of these days, worrying about food running out occurred on 597 days (22.5%), eating less than needed because there wasn't enough food occurred on 533 days (20.1%), and being hungry but not able to afford more food occurred on 298 days (11.2%). Participants reported drinking alcohol on 566 days (21.3%) with an average of 2.27 drinks (SD = 1.29).

These events co-occurred on some days. Participants drank alcohol and experienced food insecurity on 221 days (8.3%). Participants drank alcohol and missed a dose of medication on 102 days (3.8%). Missing a dose of medication and experiencing food insecurity co-occurred on 173 days (6.5%). All three of the daily measures of interest (food insecurity, missed doses and drinking alcohol) co-occurred on only 44 days (1.7%).

Food insecurity, missed doses of medication and drinking alcohol each occurred on at least one day for a large percentage of participants (See Table 5). Over the course of the study, 74.6% of participants reported at least one day of any of the three food insecurity indicators. A large proportion of participants had at least one day where they drank alcohol (83.1%). Nearly all participants had at least one day where they missed a dose of medication (91.5%).

Missing Data

Text-message survey. Of the 2655 days of text message surveys, 170 days were missing due to uncompleted surveys (6.4%). Additionally, there were several surveys that were not completed fully. Six surveys were missing the food insecurity data and ten more surveys were missing the alcohol data for a total of 16 surveys that were partially completed (0.6%).

Wisepill medication monitoring. Due to the nature of monitoring medication use, there was very little missing data on the outcome measure of adherence (2.1%). There were two instances during the course of the study that introduced missing data. One participant lost his

Wisepill device on day 30 of the study and was not given a new device per the study protocol. This resulted in 15 days of missing data for one participant. The other instance of missing data occurred when a participant's cell phone, wallet and Wisepill device were stolen on day 19 of the study. Because the device was stolen, we replaced his device but there was a 15-day lapse between when the device was stolen and when the participant could come into the office for a new Wisepill device. In addition to these situations, there were instances where the Wisepill device did not send the data in a timely fashion (N= 19; See Table 6). These situations were investigated during the course of the study and all were resolved such that the data was eventually obtained via the Wisepill device through cellular signal.

All gaps of Wisepill data greater than 48 hours were investigated (See Table 6). Over the course of the study there were 78 of them for a total of 35 people. Of those that had a data gap, there were an average of 2.29 data gaps per participant (SD = 1.51). The most common reason for a data gap was reported missed doses of medication (29.5%). In addition to reported missed doses, the following reasons were also coded as missed: reported taking doses but the data never showed up in the Wisepill database (12.8%), time spent in jail (2.6%), and unknown reasons including not being able to reach the participant to confirm the reason (3.8%). There were also reasons for Wisepill data gaps that were subsequently coded as adherent to their medications. Having a Wisepill signal lapse in which the data showed up at a later date was common (24.4%) as was reporting taking pocket doses of medications instead of using the Wisepill device (20.5%). Finally, there were 5 gaps in Wisepill data that were later attributed to participants being in the hospital. These were marked as being adherent after confirming that they received their HIV medications while hospitalized.

CHAPTER VII:

Results Part 2: Individual-Level Analyses

Food Insecurity and Medication Adherence Across the 45 Days

To replicate past literature, analyses were first conducted across the 45-day observational period using the individual as the case before moving to day-level analyses (Chapter VIII). On average, participants were 83.27% adherent to the medication in their Wisepill device (SD = 13.62; Range 50% - 100%). This variable was reasonably normal (Skewness = -0.794 [SE = 0.311], kurtosis = -0.53 [SE = 0.613]). Food insecurity was also collapsed across the 45 days to create a variable indicating the proportion of days a participant experienced any of the food insecurity indicators in order to account for days with missing data. On average, participants experienced food insecurity 30.84% of the days when data were available. This variable was reasonably normal (Skewness = 0.899 [SE = 0.311], kurtosis = -0.683 [SE = 0.613]).

To test Hypothesis 1, a bivariate linear regression was conducted with food insecurity predicting medication adherence. Food insecurity predicted medication adherence such that greater food insecurity was associated with poorer medication adherence (See Table 7; $\beta = -0.312$, $p = 0.016$). After controlling for income over the 45 days and education, the relationship between food insecurity and medication adherence remained significant ($\beta = -0.345$, $p = 0.011$).

These models were also run using each individual item of food insecurity across the 45 days. The proportion of days a participant experienced each food insecurity indicator was calculated in order to account for days with missing data. On average, participants worried about their food running out on 25.82% of the days that they were in the study. This variable was moderately positively skewed (skewness = 1.110 [SE = 0.311]) so it was transformed using the square root function. On average, participants ate less than they needed to 22.95% of the time

during the study. This variable was moderately positively skewed (skewness = 1.384 [SE = 0.311]) so it was transformed using the square root function. On average, participants experienced hunger but did not eat because they could not afford more food 13.07% of the time during the study. This variable was substantially positively skewed (skewness = 2.565 [SE = 0.311]) so it was transformed using the log10 function. Using a bivariate regression, worrying about running out of food predicted medication adherence, such that greater worry predicted lower medication adherence (See Table 7; $\beta = -0.309$, $p = 0.017$). Eating less because there was not enough food and being hungry did not predict medication adherence in individual bivariate regressions ($\beta = -0.189$, $p = 0.152$ and $\beta = -2.943$, $p = 0.100$, respectively).

Testing Moderators and Mediators at the Level of the Individual

The relationship between food insecurity and medication adherence at the level of the individual was established in this study, replicating past research. The next section tests Hypotheses 2-4 at the individual level. All variables were standardized to deal with issues of multicollinearity in moderation analyses. All tests of moderation controlled for income over 45 days and education levels.

Alcohol Use as a Moderator

Hypothesis 2 predicted that alcohol use would moderate the relationship between food insecurity and medication adherence. Alcohol use as a moderator was tested in three ways: the proportion of days a participant drank (Hypothesis 2a), the average number of drinks consumed when drinking (Hypothesis 2b), and the estimated blood alcohol concentration for participants on days when they drank (Hypothesis 2c).

Proportion of days drinking. The proportion of days a participant drank was calculated to account for days with missing data. On average, participants drank on 23.19% of days when

data 2343 available. This variable was moderately positively skewed (skewness = 1.509) so it was transformed using the square root function. In a bivariate regression, proportion of days drinking did not predict medication adherence ($\beta = -0.141$, $p = 0.285$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and proportion of days drinking was trending but not statistically significant at conventional levels ($\beta = 0.239$, $p = 0.069$; See Table 8).

Number of drinks. On average, participants drank the equivalent of 2.72 standard drinks (1.29) when they were drinking. This variable was moderately positively skewed (skewness = 1.010) so it was transformed using the square root function. In a bivariate regression, average number of drinks consumed when drinking did not predict medication adherence ($\beta = -0.198$, $p = 0.168$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and average number of drinks consumed when drinking was not significant ($\beta = 0.064$, $p = 0.685$; See Table 9).

Estimated blood alcohol concentration (eBAC). The average eBAC was calculated for all participants who drank alcohol. The average eBAC was .019 (SD = 0.0263). This variable was positively skewed (skewness = 2.998) and was transformed using the log 10 transformation. In a bivariate regression, average eBAC when drinking did not predict medication adherence ($\beta = -0.030$, $p = 0.845$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and average eBAC when drinking was not significant ($\beta = 0.142$, $p = 0.383$; See Table 10).

Reserve Capacity Model

Hypothesis 3 predicted that the constructs of the Reserve Capacity Model (Gallo & Matthews, 2003) would mediate the relationship between food insecurity and medication

adherence. Three individual mediators were tested: stressful events (Hypothesis 3a), reserve capacity (Hypothesis 3b) and emotion (Hypothesis 3c). Finally, a structural equation model was conducted to test the influence of all of the mediators simultaneously (Hypothesis 3d).

Stressful events. On average, participants experienced 3.15 stressors ($SD = 2.47$). This variable was slightly positively skewed ($skewness = 1.087$) so it was transformed using the square root function. To test whether or not stressful events mediated the relationship between food insecurity and medication adherence, the relationship between food insecurity and stressful events was modeled first. There was a significant positive relationship, such that increases in food insecurity were associated with increases in stressful events ($\beta = 0.328$, $SE = 0.110$, $p < 0.01$; See Table 11). To complete the test of mediation, both food insecurity and stressful events were included in a model predicting medication adherence. In this model, stressful events did not predict medication adherence. Additionally, food insecurity significantly predicted medication adherence even when accounting for stressful events ($\beta = -5.476$, $SE = 2.103$, $p < 0.05$). The direct and indirect effects of the mediation model were calculated through bootstrapping. Using this method, the direct effect of food insecurity on medication adherence was significant ($\beta = -5.412$, 95% CI $(-9.194, -1.740)$, $p < 0.001$). The casual mediation effect was not significant, indicating that stressful events did not mediate the relationship between food insecurity and medication adherence ($\beta = 0.196$, 95% CI $(-1.066, 1.803)$, $p = 0.86$).

Reserve capacity. The Reserve Capacity construct is calculated as resilient resources (control, self-esteem, social support) minus stress exacerbating resources (pessimism, social conflict). This variable was normally distributed. To test whether reserve capacity mediated the relationship between food insecurity and medication adherence, the relationship between food insecurity and reserve capacity was modeled first. There was a significant negative relationship,

such that increases in food insecurity were associated with decreases in reserve capacity ($\beta = -0.120$, $SE = 0.077$, $p < 0.05$; See Table 12). To complete the test of mediation, both food insecurity and reserve capacity were included in a model predicting medication adherence. In this model, reserve capacity did not predict medication adherence. Additionally, food insecurity significantly predicted medication adherence even when accounting for reserve capacity ($\beta = -5.315$, $SE = 2.034$, $p < 0.05$). The bootstrapped direct effect of food insecurity on medication adherence was significant ($\beta = -5.323$, 95% CI (-9.487, -1.588), $p < 0.001$). The casual mediation effect was not significant, indicating that reserve capacity did not mediate the relationship between food insecurity and medication adherence ($\beta = 0.920$, 95% CI (-0.251, 3.038), $p = 0.19$).

Emotion. The emotion construct was calculated as a sum of positive and negative (reverse coded) emotions. This variable was normally distributed and had acceptable reliability (Cronbach's $\alpha = 0.74$). To test whether or not emotions mediated the relationship between food insecurity and medication adherence, the relationship between food insecurity and emotions was modeled first. There was a significant negative relationship, such that increases in food insecurity were associated with decreases in positive emotions ($\beta = -0.239$, $SE = 0.103$, $p < 0.05$; See Table 13). To complete the test of mediation, both food insecurity and emotions were included in a model predicting medication adherence. In this model, emotions did not predict medication adherence. Additionally, food insecurity significantly predicted medication adherence even when accounting for emotions ($\beta = -4.316$, $SE = 1.959$, $p < 0.05$). The bootstrapped direct effect of food insecurity on medication adherence was significant ($\beta = -4.293$, 95% CI (-7.886, -0.300), $p = 0.05$). The casual mediation effect was not significant, indicating that emotion did not mediate the relationship between food insecurity and medication

adherence ($\beta = 0.526$, 95% CI (-0.661, 1.931), $p=0.38$). [Note: These models were also run separately with positive emotions and negative emotions separately and the results did not differ substantially other than the direction of the relationships for the negative emotion composite. The mediation models, however, were still non-significant.]

Testing the Reserve Capacity Model. A structural equation model of the multiple mediators proposed in the Reserve Capacity Model (Gallo & Matthews, 2003) was tested (See Figure 2). All of the mediations were modeled simultaneously while controlling for income over the 45 days and education. This model had good fit: $X^2 = 11.853$, $p = .295$; CFI = 0.965; RMSEA = .057. [Note: A previous model controlling for baseline values of stressful events, reserve capacity and emotion had very poor fit (CFI = 0.195; RMSEA = 0.299)]. Food insecurity significantly predicted stressful events ($\beta = 0.442$, $p<0.001$) and reserve capacity ($\beta = -0.493$, $p<0.001$) but did not significantly predict emotion ($\beta = -0.105$, $p=0.397$). The Reserve Capacity Model also specifies that emotions will mediate the path between reserve capacity and behavior as well as the path between stressful events and behavior. I found reserve capacity significantly predicted emotion ($\beta = 0.560$, $p<0.001$) but stressful events did not ($\beta = -0.136$, $p = 0.220$). Furthermore, emotion did not significantly predict medication adherence ($\beta = 0.122$, $p = 0.459$). Reserve capacity and stressful events also did not significantly predict medication adherence ($\beta = -0.130$, $p = 0.441$, $\beta = 0.067$, $p = 0.629$, respectively). Finally, food insecurity still directly predicted medication adherence even after controlling for the components of the reserve capacity model ($\beta = -0.373$, $p = 0.015$).

Distance to Resources as Moderators

The distances to important resources were tested as moderators of the relationship between food insecurity and medication adherence across the 45-day observational period

(Hypothesis 4). Four individual moderators were tested: distance to Atlanta's city center (5 points) from participant's home address (Hypothesis 4a), distance to the nearest supermarket (Hypothesis 4b), distance to the nearest public transportation stop (bus/train; Hypothesis 4c) and the distance to the participant's pharmacy (Hypothesis 4d).

City center. The median distance from city center was 4.88 miles. This variable had a substantial positive skew (skewness = 2.459) so it was transformed using a log10 transformation. In a bivariate regression, distance to city center did not predict medication adherence ($\beta = -0.017$, $p = 0.904$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and distance to city center was not significant ($\beta = -0.161$, $p = 0.391$; See Table 14).

Nearest supermarket. The median distance from the supermarket nearest to the participant's home address was 0.59 miles. This variable had a moderate positive skew (skewness = 1.273) so it was transformed using a square root transformation. In a bivariate regression, distance to the nearest supermarket did not predict medication adherence ($\beta = -0.013$, $p = 0.928$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and distance to the nearest supermarket was not significant ($\beta = -0.104$, $p = 0.479$; See Table 15).

Nearest public transportation stop. The median distance from the public transportation stop (MARTA train or bus) nearest to the participant's home address was 0.80 miles. This variable had a substantial positive skew (skewness = 3.983) so it was transformed using a log10 transformation. In a bivariate regression, distance to the nearest train or bus stop did not predict medication adherence ($\beta = -0.206$, $p = 0.138$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and

distance to the nearest transportation trending on significance ($\beta = 0.248$, $p = 0.091$; See Table 16). Individuals that live further from a public transportation stop and had high food insecurity had the lowest adherence ($M = 79.17$, $SD = 12.97$). [Note: when the interaction model was run controlling for having difficulty with transportation over the 45 days, the interaction was no longer trending ($\beta = 0.250$, $p = 0.104$) and having difficulty with transportation did not predict adherence ($\beta = 0.013$, $p = 0.956$)].

Distance to participant's pharmacy. The median distance from the participant's pharmacy was 4.59 miles. This variable had a moderate positive skew (skewness = 1.150) so it was transformed using a square root transformation. In a bivariate regression, distance to the participant's pharmacy did not predict medication adherence ($\beta = .087$, $p = 0.558$). When tested as a moderator of the relationship between food insecurity and medication adherence, the interaction between food insecurity and distance to participant's pharmacy was not significant ($\beta = -0.060$, $p = 0.688$; See Table 17).

CHAPTER VIII:

Results Part 3: Day-Level Analyses

The relationship between food insecurity and medication adherence was established in this study at the individual level. The following section details analyses aimed at establishing this relationship on day-level.

Test of Reactivity to the Daily Measurement

A simple model of day predicting missed dose was conducted with day nested within participant (See Appendix I for the code used to run these and all subsequent analyses in R including process notes). Day in the study predicted missed doses such that the longer participants were in the study, the more likely they were to miss doses using the Wisepill device ($B = 0.017$, $SE = 0.006$, $p = 0.008$). The same model was also run with food insecurity, as defined by answering yes to any of the three food insecurity items on a given day. Day in the study predicted food insecurity such that the longer participants were in the study, the less likely they were to report food insecurity ($B = -0.029$, $SE = 0.010$, $p = 0.004$). All subsequent analyses control for the effect of day. Figure 3 shows the trends of the daily variables of interest (i.e. missed doses of medication, food insecurity, and alcohol) over time.

Food Insecurity and Medication Adherence on a Daily Level

A multilevel model was conducted to test Hypothesis 1, which proposes that food insecurity will predict medication adherence at the daily level. However, results showed that taking the aggregate of food insecurity did not predict missed doses of medication on a daily level ($B = -0.053$, $SE = 0.236$, $p=0.82$; See Model 1 in Table 18). I also checked whether controlling for income over the 45 days and education would impact these results, however, food insecurity still did not predict missed doses of medication on a daily level ($B = -0.090$, $SE = 0.245$, $p=0.71$; See Model 2 in Table 18).

These models were also run using each individual indicator of food insecurity; worrying about food running out and eating less than needed to because there wasn't enough food were not significant predictors of daily missed doses (worry: $B = -0.198$, $SE = 0.321$, $p=0.54$; ate less: $B = 0.019$, $SE = 0.242$, $p=0.94$). Severe food insecurity as indexed by the hunger item, however, did significantly predict daily missed doses of medication such that daily reported hunger was associated with a greater likelihood of missing a dose of medication on a daily level ($B = 0.531$, $SE = 0.265$, $p=0.045$; See Model 1 in Table 19). This relationship held even after controlling for income over the 45 days and education ($B = 0.570$, $SE = 0.285$, $p = 0.045$; See Model 2 in Table 19).

Moderators and Mediators of the Daily Relationship Between Hunger and Missed Doses of Medication

In the previous section, I have established that a daily relationship exists between severe food insecurity (i.e. hunger) and missing doses of ARV medications. In order to better understand this relationship, several moderators and mediators were tested that have support in the literature in cross-sectional and longitudinal, but not yet in daily analyses.

Alcohol Use as a Moderator

Alcohol is a strong predictor of medication adherence on a daily level in the HIV literature (Parsons, Rosof, & Mustanski, 2008). Additionally, alcohol may act as a moderator of the relationship between food insecurity and medication adherence. For example, individuals who are severely food insecure and expend resources on alcohol may demonstrate poorer adherence than those who do not drink. Alternatively, alcohol may be used as a maladaptive coping strategy for severe food insecurity and facilitating better adherence. This moderation was tested in three ways on a daily level (Hypothesis 2): whether or not a participant drank on a given

day (Hypothesis 2a), how many standard drinks were consumed on a day when a participant was drinking (Hypothesis 2b), and the estimated blood alcohol concentration (eBAC) of a participant when he/she was drinking (Hypothesis 2c).

Drinking on a given day. Whether or not a participant was drinking on a given day was tested as a moderator of the daily relationship between hunger and missing a dose of medication (See Table 20). As expected, drinking on a given day predicted missing a dose of medication on a daily level ($B = 0.731$, $SE = 0.319$, $p = 0.022$). When accounting for daily alcohol use, hunger was no longer significant predictor of missing a dose of medication ($B = 0.673$, $SE = 0.474$, $p = 0.156$). There was a significant interaction between drinking and experiencing hunger ($B = -1.919$, $SE = 0.575$, $p < 0.001$). This interaction, however, was in an unexpected direction (See Figure 4). Those who drank alcohol and experienced hunger on a given day had the lowest likelihood of missing a dose on that day. Those that did not drink alcohol but did experience hunger on a given day were the most likely to miss a dose of medication on that day.

There were 85 days in which participants drank and were hungry and 18 participants contributed at least one of those days. One participant contributed 38 days (44.7%) and this participant had higher than average adherence (90.9%). A post hoc analysis was conducted excluding this participant to determine if this one individual was driving the interaction. However, we found that the interaction remained largely unchanged when this individual was excluded ($B = -1.911$, $SE = 0.693$, $p = 0.005$).

Number of drinks. The number of drinks that were consumed during a day when a participant was drinking was also tested as a moderator of the relationship between hunger and food insecurity (See Table 21). When number of drinks consumed on days participants drank was entered into the equation, hunger no longer predicted missing a dose of medication ($B = -$

1.343, SE = 0.1.779, $p = 0.450$). Additionally, the number of drinks consumed did not predict missing doses ($B = 0.009$, SE = 0.577, $p = 0.986$) nor was the interaction between number of drinks and hunger significant ($B = 0.100$, SE = 0.706, $p = 0.887$).

Estimated blood alcohol concentration. The final alcohol moderator that was tested was estimated blood alcohol concentration (eBAC; See Table 22). When the eBAC was entered into the equation, hunger no longer predicted missing doses of medication ($B = -1.127$, SE = 0.743, $p = 0.130$). eBAC did not predict missing a dose of medication ($B = -0.039$, SE = 0.192, $p = 0.838$) nor was the interaction between eBAC and hunger significant ($B = 0.497$, SE = 0.432, $p = 0.249$).

Reserve Capacity Model

Hypothesis 3 predicted that the constructs of the Reserve Capacity Model (Gallo & Matthews, 2003) would mediate the daily relationship between hunger and missed doses of medication. Three individual mediators were tested: stressful events (Hypothesis 3a), reserve capacity (Hypothesis 3b) and emotion (Hypothesis 3c). Finally, a structural equation model was conducted to test the influence of all of the mediators simultaneously (Hypothesis 3d).

Stressful events. A composite of stressful experiences reported at the follow-up was tested as a potential mediator of the daily relationship between hunger and missed doses of medication (Hypothesis 3a; See Table 23). Hunger did not significantly predict stressful events. Additionally, stressors at follow-up did not significantly predict missed doses of medication on the daily level. Daily hunger remained a significant predictor of missed doses of medication even when stressful experiences were included in the model. Thus, stressful events did not mediate the relationship between hunger and missed doses of medication.

Reserve capacity. The calculated reserve capacity score at follow-up was tested as a potential mediator of the daily relationship between hunger and missed doses of medication (Hypothesis 3b; See Table 24). Hunger did not significantly predict reserve capacity. Additionally, reserve capacity at follow-up did not significantly predict missed doses of medication on the daily level. Although daily hunger was not a significant predictor of missed doses of medication when reserve capacity was included in the model, reserve capacity was not shown to be a mediator of this relationship.

Emotion. The calculated emotion score at follow-up was tested as a potential mediator of the daily relationship between hunger and missed doses of medication (Hypothesis 3c; See Table 25). Hunger did not significantly predict emotions. Additionally, emotions at follow-up did not significantly predict missed doses of medication on the daily level. Although daily hunger was not a significant predictor of missed doses of medication when emotions were included in the model, emotions were not shown to be a mediator of this relationship.

Testing the Reserve Capacity Model. A multilevel structural equation model (SEM) of the multiple mediators proposed in the Reserve Capacity Model (Gallo & Matthews, 2003) was tested (See Figure 5). All of the mediations were modeled simultaneously while controlling for income over 45 days and education. [Note: Fit indices and residual variances for two-level random effects models with categorical outcomes are not available in MPlus and thus are not reported here.] The path results from the multilevel SEM strongly mirrored those found in the individual level data analyses (See Table 26).

Hunger significantly predicted stressful events ($B = 3.290$, $SE = 0.897$, $p < 0.001$) and reserve capacity ($B = -9.067$, $SE = 2.027$, $p < 0.001$) but did not significantly predict emotion ($B = 0.745$, $SE = 0.555$, $p = 0.180$). Reserve capacity significantly predicted emotion ($B = 0.632$, $SE =$

0.022, $p < 0.001$) but stressful events did not ($B = 0.013$, $SE = 0.032$, $p = 0.675$). Furthermore, emotion did not significantly predict missing a dose of medication ($B = -0.454$, $SE = 0.349$, $p = 0.193$). Reserve capacity and stressful events also did not significantly predict missing a dose of medication ($B = 0.327$, $SE = 0.228$, $p = 0.152$, $B = 0.086$, $SE = 0.098$, $p = 0.382$, respectively). Finally, hunger still directly predicted missing a dose of medication even after controlling for the components of the reserve capacity model ($B = 2.137$, $SE = 0.862$, $p = 0.013$).

A growth model was also modeled simultaneously (Hedeker, 2004). Income over 45 days, education, stressful events, reserve capacity and emotion all did not predict the slope of the relationship between time and missed doses of medication (Table 26). Stressful events have a significant positive effect on the intercept of missed doses such that greater stressful events were associated with a higher likelihood of missing a dose of medication. Slope of the relationship of hunger predicting missed doses of medication also had a significant positive effect on the intercept of missed doses such that greater slopes were associated with a higher likelihood of missing a dose of medication.

Distance to Resources as Moderators

There is some evidence in the literature that distance from resources is a moderator of the relationship between food insecurity and ARV medication adherence (Kalichman et al., 2011), however, these moderators have not been tested on a daily level (Hypothesis 4)

City center. The distance between a participant's home address to Atlanta city center (5 Points) was tested as a cross-level moderator of the daily relationship between hunger and missed doses of medication (Hypothesis 4a; See Table 27). When entered into the model, distance to city center was not directly related to missed doses of medications ($B = -0.204$, $SE = 0.214$, $p = 0.340$) nor was the interaction between distance to city center and hunger significant

($B = 0.238$, $SE = 0.348$, $p = 0.494$). These findings do not replicate Kalichman et al.'s (2011) main finding on a daily basis.

Nearest supermarket. The distance between a participant's home address to the nearest supermarket was tested as a moderator of the daily relationship between hunger and missed doses of medication (Hypothesis 4b; See Table 28). When entered into the model, distance to the nearest supermarket was not directly related to missed doses of medications ($B = 0.009$, $SE = 0.211$, $p = 0.968$). Additionally, the interaction between distance to nearest supermarket and hunger was not significant ($B = 0.114$, $SE = 0.017$, $p = 0.918$).

Nearest public transportation stop. The distance between a participant's home address to the nearest public transportation stop was tested as a moderator of the daily relationship between hunger and missed doses of medication (Hypothesis 4c; See Table 29). When entered into the model, distance to the nearest public transportation stop was not directly related to missed doses of medications ($B = 0.222$, $SE = 0.193$, $p = 0.251$). Additionally, the interaction between distance to nearest public transportation stop and hunger was not significant ($B = -0.056$, $SE = 0.259$, $p = 0.829$). I also tested this model controlling for daily responses to "I had trouble getting where I needed to go" (Yes/No). This did not substantially change the model.

Distance to participant's pharmacy. The distance between a participant's home address to their pharmacy was tested as a moderator of the daily relationship between hunger and missed doses of medication (Hypothesis 4d; See Table 30). When entered into the model, distance to their pharmacy was not directly related to missed doses of medications ($B = 0.068$, $SE = 0.230$, $p = 0.769$). Additionally, the interaction between distance to nearest supermarket and hunger was not significant ($B = 0.082$, $SE = 0.266$, $p = 0.757$).

CHAPTER IX: Discussion

The current study replicates findings from both resource poor and resource rich settings that demonstrate that food insecurity predicts medication adherence on the individual level, even when controlling for other markers of socioeconomic status, such as income and education. Additionally, this study extends the literature by observing this relationship on a daily level. Specifically, the most severe aspect of food insecurity, hunger, was directly related to missing medication on a daily basis.

This day level finding supports a more direct relationship between food and medication adherence, such that having tangible resources impacts health behaviors (Johnson et al., 2010). This also lends credence to the potential explanations for the relationship between food insecurity and ARV adherence. Food requirements of prescriptions, avoiding side effects associated with taking medications on an empty stomach and competing resource demands are all potential explanations of the temporal link between day level food insecurity and day level medication non-adherence. Although these explanations were not specifically tested in this study, the current findings open the door for future research to tease apart these mechanisms.

This study did not find much support at the day level for the individual level moderators or mediators found in the literature (Weiser et al., 2011; Kalichman et al., 2011). The only interaction that was significant at the daily level was for whether or not a participant drank alcohol on a given day. Drinking on a given day predicted missing HIV medications replicating past day level research (Parsons, Rosof, & Mustanski, 2008). There was also an interaction between hunger and drinking alcohol, but in a direction opposite of what was predicted. Those who drank alcohol and were hungry on a given day were the least likely to miss a dose of

medication on that day. There are several potential explanations of this reversed relationship. The hunger item does not factor in severity. It is plausible that those that were hungry but still drinking were less hungry than those that were hungry and not drinking alcohol. This plausible difference in hunger severity may have masked the expected relationship, where greater alcohol use and food insecurity would predict non-adherence. Additionally, this interaction could be a statistical fluke, particularly considering the dichotomization of two of the variables of interest (i.e. hunger and drinking) especially when considering that the two other day-level alcohol findings, which statistically consider more information but found no interaction (Streiner, 2002). Also possible is the role of alcohol use in coping with extreme poverty. Although maladaptive, drinking may reduce the stress of poverty, even if diverting resources away from food. Thus, stress reduction could account for the paradoxically better adherence among drinkers experiencing food insecurity. These alcohol findings should be replicated before we consider this counterintuitive interaction to be true, particularly by using more sensitive measurements for hunger.

The Reserve Capacity Model constructs did not mediate the relationship between hunger and missing doses of medication on a daily level. It is possible that the psychosocial constructs that were used as mediators (i.e. stressful events, reserve capacity composite, and emotions) were measured too distally. Previous research that looked at these constructs in relation to SES measured them on a daily level (Gallo, Bogart, Vranceanu, & Matthews, 2005). It is possible that more nuanced measurement that could capture daily fluctuations in these psychosocial constructs, particularly emotions, would serve as a better test of the Reserve Capacity Model as a mediator of the relationship between hunger and missed doses of medication. These constructs were not measured at the daily level for this study because of the burden associated with the

measurement. The previous daily study that looked at these constructs did so over the course of two days (Gallo, Bogart, Vranceanu, & Matthews, 2005). Given that the current study was substantially longer, measuring these constructs on a daily level in addition to the daily measurement of food insecurity and alcohol use was deemed too burdensome. That said, future studies that are shorter in duration may still consider these constructs as potential mediators.

Geography, in general, has a significant impact on health and well-being (Drummer, 2008; Fleuret & Atkinson, 2007), however, in the current study the geospatial moderators, which tested the distance to potential resources, were not significant. It is possible that with the specific relationship between food insecurity and medication adherence, distance to resources is not the biggest barrier. For example, distance to the nearest supermarket may be one barrier to acquiring the food necessary to take ones' medications but what may matter more is whether or not that individual has enough money to buy the food. The distance to the supermarket becomes irrelevant if the individual cannot buy food once he/she gets there. The number of individuals living 5 miles or more outside of Atlanta was comparable to the previous study (Kalichman et al., 2011: 40%; current study: 45%) so variability was probably not an issue in this sample.

There was potential reactivity to the daily measurement both for missed doses of medication and food insecurity defined as indicating yes to any of the three daily food insecurity questions. Participants were more likely to miss doses of medication the longer that they were in the study. A possible explanation for this is that using the Wisepill device may have served as a reminder for participants to take their medications at the beginning of the study, but as the study progressed, the Wisepill device became less of a reminder. In our study, participants were asked whether or not they thought the Wisepill device helped them remember to take their medications. A large majority (84.2%, N = 48) agreed or strongly agreed that the Wisepill device helped them

to remember. This perception has also been found in other studies using the Wisepill device with HIV positive adults in China and Uganda (Bachman DeSilva et al., 2013; Haberer et al., 2010).

Additionally, participants were less likely to report food insecurity the longer they were in the study. Other daily diary studies have found similar measurement reactivity and have proposed that reporting about emotions, cognitions, and behavior on a daily basis may actual change these thoughts and behaviors due to self-reflection (Affleck, Zaurta, Tennen & Armeli, 1999). Although it is possible in this study that reporting on food insecurity may have made participants realize that they were struggling with food and prompted them to make changes, this is an unlikely explanation. When living in poverty and suffering from food insecurity, it is not easy to change ones social position and obtain necessary resources (Goldsmith & Blakely, 2010; Sawhill, 1988). I did collect daily data about whether or not participants received food from a pantry, church, a friend or from the street. If reporting on food insecurity prompted participants to seek out more resources, there would be a significant positive trend, such that the longer participants were in the study, the more likely they would report receiving food assistance from other places. A post hoc analysis showed that there was a significant trend, however, it was in the opposite direction, such that participants were less likely to report getting food from a pantry the longer they were in the study. Thus, although reporting on food insecurity may have made participants more aware of their struggles, it is unlikely that the measurement changed their actual food insecurity.

Post hoc testing of reactivity looking at the daily food insecurity questions separately found that there was reactivity to the question about worrying about having enough to eat and eating less because there was not enough food. However, day in the study did not significantly predict the question about hunger, which was the item found to be directly related to daily

missed doses of medication and was used in all mediator and moderator analyses. The measurement reactivity specific to the worry and ate less questions may have masked the direct relationship between these two questions and missing doses of medication on a daily level. Future research may take these factors into account and perhaps lag the time between starting using the Wisepill device and starting the daily food insecurity measurement, such that participants start using the Wisepill device several weeks before starting the daily food insecurity measurement and measuring daily food insecurity for a shorter amount of time.

Limitations

There were several limitations to this study that should be taken into account. First, there is the limitation of geographical location. This study was conducted in one large southeastern U.S. city. It is possible that the results of this study do not generalize to other cities within the U.S. or suburban or rural areas of the U.S, particularly the mediator and moderator analyses. The influence of geospatial and psychosocial factors can vary widely based on individuals and context. In particular, the influence of geospatial factors (i.e. distance to potential resources) that I did not find to be a significant moderator the relationship between food insecurity and medication adherence may play a larger role in other geographical locations. Influence of geospatial factors may play more of a role, particularly in rural parts of the U.S. and sub-Saharan Africa, where distances to doctors and pharmacies are far greater and pose a significant barrier to medication adherence (Morojele, Kekwaletswe, & Nkosi, 2014). Thus, the fact that this study was only conducted in Atlanta, GA may limit the generalizability of the current studies findings to other areas of the U.S., other resource rich countries as well as resource poor countries.

Additionally, almost the entire sample for this study identified as African-American (96%). There may be racial factors that play a role in the relationship between food insecurity

and medication adherence such as race-based medical mistrust (Eaton et al., 2015; Gaston & Alleyne-Green, 2013), racial prejudice/discrimination (Bogart, Wagner, Galvan, & Klein, 2010), and racial stigma (Earnshaw, Bogart, Dovidio, & Williams, 2013; Earnshaw, Smith, Chaudoir, Amico, & Copenhaver, 2013; Loury, 2003). It is possible that these factors may strengthen or weaken the relationship between food insecurity and medication adherence, however, we cannot test these potential moderators due to the lack of racial variability in the sample.

Another limitation of the current study deals with the daily food insecurity assessment. The items that comprised the daily food insecurity assessment were a shortened version of the validated USDA scale (Bickel, Nord, Price, Hamilton, & Cook, 2000). In order to make the text assessment short enough that participants would complete the entire survey each day, I could not include the entire 10 items of this scale. Thus, the daily assessment of food insecurity was not as nuanced as it could have been because only worry, eating less, and hunger were assessed. For example, items that assessed food running out and not having enough money to buy more, being able to afford balanced meals, and weight loss because there wasn't enough money to buy food were not assessed on the daily level. Although eliminating these particular items lead to a less nuanced picture of daily food insecurity, the items that were used in the daily assessment provide range of food insecurity, albeit a smaller one than if the full assessment was used.

In addition to a reduction in the number of items that could be assessed, the mode of assessment (i.e. daily text messaging) also limited the number of text characters that could be used. Thus, some of the food insecurity questions had to be shortened from their original versions. For example the item “ I worried about my food running out yesterday” was adapted from USDA Household Food Security survey’s original item “We worried whether our food would run out before we got money to buy more.” These wording alterations required training

participants on the front end about what the text messages were asking about. Over the course of the study, participants may have forgotten the specifics of the text message training.

This study may have also been limited by our measure of blood alcohol concentration. Instead of having participants provide actual breath alcohol concentrations every day for 45 days, we retrospectively calculated estimated blood alcohol concentrations (eBACs). eBACs correlate with actual breath alcohol concentrations between 0.54 and 0.55 (Hustad & Carey, 2005) and eBACs may overestimate or underestimate actual breath alcohol concentrations depending on context (Clapp et al., 2009). This planned measurement error may have impacted the results. It is possible that actual breath alcohol concentrations may have moderated the daily relationship between hunger and missed doses of medication.

A final limitation of the study was the Wisepill signal lapse protocol. In order to ensure that the devices were working properly and that participants were using their Wisepill devices for medication management, participants were called every time that there was a Wisepill signal lapse of greater than 48 hours in order to investigate the reason for the lapse. These signal lapses phone calls may have helped some participants remember to take their medications but were necessary to ensure that the Wisepill devices were working and being used properly. Although these calls may have served as a reminder on the day that the call was made, it is unlikely that these calls influenced medication adherence across time given the time trends in the Wisepill data. If participant were missing doses and then called due to a 48 hour Wisepill signal lapse and this then prompted them to start being more adherent to their medications, there would be a negative trend in the data such that the longer participants were in the study, the less likely they would be to miss a dose of medication. In our study, however, we see the exact opposite trend in

the data; participants were more likely to miss a dose of medication the longer they were in the study.

Implications and Future Directions

The results of this study support the assumption in the literature that, food insecurity and medication adherence are directly related due to circumstances that occur at the daily level. Food insecurity is not just a marker for social disadvantage. There are specific features of food insecurity that influence health behavior, particularly medication-taking, over and above socioeconomic status. This study replicates findings from previous cross-sectional and longitudinal studies as well as extended the literature by showing this daily relationship between hunger and missed doses of medication. Future research should replicate these findings in other locations, including rural areas of both resource rich and resource poor countries to provide conclusive evidence for this daily relationship.

This study, however, failed to explain why and under what circumstances the relationship between food insecurity and medication adherence is most the important and/or detrimental. Surprisingly, none of the potential mediators/moderators put forth by Weiser et al. (2011) that were tested in this study showed a significant impact on the day-level relationship. Measuring psychological variables more proximally to food insecurity and missed doses of medication may prove more fruitful. Additionally, more accurate measures of alcohol use, such as breath or actual blood alcohol concentrations may also provide more information.

Currently, all of the potential explanations for this daily relationship are plausible, however, the different explanations require vastly different approaches for solving this issue. For example, the explanation of intentional non-adherence due to partially following drug prescriptions that have food requirements, necessitates both psychological as well as

pharmaceutical solutions. Psychologically based interventions can address individual decision-making around medication adherence behaviors. Advances in pharmaceutical technologies can also address this issue by creating new drugs (particularly non-nucleoside reverse transcriptase inhibitors and protease inhibitors) that do not have food requirements associated with taking them.

The potential explanation of competing resource demands, however, requires psychological and structural solutions. Psychologically based interventions can address skills-building for how to navigate the social services system as well as how to seek out potential resources such as food pantries. Structural changes would also be necessary to make these types of services and resources more available to those living in poverty. Future research should tease apart these potential explanations in order to better understand the daily relationship between food insecurity and medication adherence and the ways that we can intervene.

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Table 1: Demographic characteristics of participants enrolled in the current study (N=59)

	N	%
Gender		
Male	40	67.8
Female	12	20.3
Transgender	7	11.9
Race/Ethnicity		
White	1	1.7
African American/Black	57	96.6
Hispanic/Latino	1	1.7
Sexual Orientation		
Gay/Homosexual	28	47.5
Bisexual	10	16.9
Heterosexual	21	35.6
Education		
Less than High School	12	20.3
High school/GED	21	35.6
More than High School	26	44.1
Types of Income Received Over 45 days^		
Job (Part Time/Full Time)	9	15.8
Average Amount M= \$1814.44		
Any Disability (Short-time/SSDI)	45	78.9
Average Amount M= \$1268.73		
Unemployment	1	1.8
Average Amount M= \$912		
Food Stamps	37	64.9
Average Amount M= \$176.14		
Other	5	8.8
Average Amount M= \$359.20		
	M	SD
Income Over 45 Days	\$1,472.66	1323.93
Age Range (30-59)	48	6.62

^Missing data for 2 participants, percentages are out of 57

Table 2: Baseline physical health characteristics

	N	%
BMI		
Underweight (<18.5)	0	0
Normal (18.5-24.9)	22	37.3
Overweight (25-29.9)	22	37.3
Obese (>30.0)	15	25.4
Viral Load^		
Detectable <50	10	18.9
Undetectable	43	81.1
CD4 (T-Cell) Count^		
200 or less	6	11.5
Greater than 200	46	88.5
Medication Food Requirement		
Regimen Requires Food	36	61
Regimen Does Not Require Food	23	39
Times spent in hospital for HIV		
0	26	44.1
1	10	16.9
2	7	11.9
3	6	10.2
4	4	6.8
5+	6	10.2
	M	SD
Weight	185.08	42.5
BMI	28.01	6.96
Visual Analog Scale	84.54	18.62
Horne Medication Necessity Beliefs		
Range of Responses (5-25)	22.56	2.83
Horne Medication Concerns		
Range of Responses (5-25)	13.29	4.33

^Note: There was missing viral load data from 6 participants and missing CD4 data from 7 participants

Table 3: Baseline psychosocial characteristics

Psychosocial Measures (Response Ranges)	M	SD
AUDIT (0-40)	5.81	5.72
Food Insecurity (0-7)	2.78	2.62
12 item CES-D (0-36)	12.63	7.52
Perceived Control (7-35)	26.98	5.58
Self-Esteem (10-50)	39.44	6.69
Social Support (10-40)	29.66	6.71
Pessimism (10-50)	23.64	5.77
Social Stress (0-48)	11.9	10.68
Number of Stressors (0-18)	3.85	3.07

Table 4: Day-level behaviors based on 2,655 days of collected data

	# of Days	%
Missed Dose of Medication	530	20.0
Any Indicator of Food Insecurity (FI)	718	27.0
Worry	597	22.5
Ate Less	533	20.1
Hunger	298	11.2
Drank Alcohol	566	21.3
Co-occurring days		
Drank & Any FI	211	8.3
Drank & Missed Dose	102	3.8
Missed Dose & Any FI	173	6.5
All	44	1.7

Table 5: Percentage of participants that experienced at least one day of the daily measured behaviors

	N	%
Missed Dose of Medication	54	91.5
Any Indicator of Food Insecurity (FI)	44	74.6
Worry	38	64.4
Ate Less	44	74.6
Hunger	33	55.9
Drank Alcohol	49	83.1

Table 6: Investigated Wisepill signal lapses of >48 hours and their outcomes

Marked as Missed	N	%
Missed Dose	23	29.5
Reported taking but doses never showed	10	12.8
Jail Time	2	2.6
Unknown	3	3.8
Adjusted Adherence		
Signal Lapse but data appeared later	19	24.4
Pocket Doses	16	20.5
Hospitalization	5	6.4

Table 7: Bivariate and multivariate regressions predicting ARV medication adherence across the 45-day observational period; N= 59 individuals

Predictors	Bivariate Regression			Multivariate Regression		
	B	SE	Beta	B	SE	Beta
Any Food Indicator	-4.25	1.714	-0.312*	-4.698	1.786	-0.345*
Worry	-4.211	1.716	-0.309*			
Ate Less	-2.573	1.772	-0.189			
Hungry	-2.943	1.762	-0.216^			
Income over 45 days	-1.293	1.841	-0.095	-2.178	1.82	-0.16
Education	0.398	1.804	0.029	1.781	1.789	0.133

*p<0.05

Table 8: Testing proportion of days drinking as a potential moderator using individual level data

Variable	B	SE	Beta
Food Insecurity	-5.03	1.826	-0.369**
Income over 45 days	-2.345	1.855	-0.173
Education	1.938	1.773	1.45
Drinking (Yes/No)	-0.349	1.815	-0.26
Food Insecurity X Drinking (Yes/No)	3.234	1.741	0.239^
R square		0.188	

^p<0.10, *p<0.05, **p<0.01

Table 9: Testing number of drinks when drinking as a potential moderator using individual level data

Variable	B	SE	Beta
Food Insecurity	-3.48	2.125	-0.251
Income over 45 days	-0.626	2.27	-0.045
Education	0.426	2.13	0.033
Number of Drinks	-2.232	2.226	-0.164
Food Insecurity X Number of Drinks	0.908	2.224	0.064
R square		0.112	

[^]p<0.10, *p<0.05, **p<0.01

Table 10: Testing estimated blood alcohol concentrations (eBACs) when drinking as a potential moderator using individual level data

Variable	B	SE	Beta
Food Insecurity	-2.972	2.244	-0.22
Income over 45 days	-1.354	2.35	-0.098
Education	-0.069	2.211	-0.005
Drinking(Yes/No)	-0.766	2.211	-0.056
Food Insecurity X Drinking (Yes/No)	2.088	2.365	0.142
R square		0.076	

[^]p<0.10, *p<0.05, **p<0.01

Table 11: Testing stressful events as a potential mediator using individual level data

	Model of path a predicting stressors at follow-up		Model of path b and c' predicting medication adherence	
	B	SE	B	SE
Food Insecurity	0.328**	0.110	-5.476*	2.103
Stressors at Baseline	0.248*	0.119	1.270	1.989
Stressors at Follow-up			0.614	2.250
Income over 45 Days	-0.123	0.115	-2.051	1.867
Education	0.241*	0.113	1.508	1.900
Standard errors and standard deviations are in parentheses; ^p<0.10, *p<0.05, **p<0.01, ***p<0.001; All analyses control for education and income				

Direct Effect: -5.412, 95% CI (-9.194, -1.740), p<0.001

Causal Mediation Effect: 0.196, 95% CI (-1.066, 1.803), p=0.86

Table 12: Testing reserve capacity as a potential mediator using individual level data

	Model of path a predicting reserve capacity at follow-up		Model of path b and c' predicting medication adherence	
	B	SE	B	SE
Food Insecurity	-0.120*	0.077	-5.315*	2.034
Reserve Capacity at Baseline	0.776***	0.077	4.761	3.316
Reserve Capacity at Follow-up			-4.864	3.493
Income over 45 Days	-0.079	0.074	-2.719	1.863
Education	-0.024	0.072	1.773	1.800
Standard errors and standard deviations are in parentheses; ^p<0.10, *p<0.05, **p<0.01, ***p<0.001; All analyses control for education and income				

Direct Effect: -5.323, 95% CI (-9.487, -1.588), p<0.001

Causal Mediation Effect: 0.920, 95% CI (-0.251, 3.038), p=0.19

Table 13: Testing emotions as a potential mediator using individual level data

	Model of path a predicting emotion at follow-up		Model of path b and c' predicting medication adherence	
	B	SE	B	SE
Food Insecurity	-0.239*	0.103	-4.316*	1.959
Emotion at Baseline	0.627***	0.107	4.198	1.959
Emotion at Follow-up			-2.047	2.541
Income over 45 Days	0.016	0.099	-2.407	1.813
Education	-0.089	0.099	1.960	1.803
Standard errors and standard deviations are in parentheses; ^p<0.10, *p<0.05, **p<0.01, ***p<0.001; All analyses control for education and income				

Direct Effect: -4.293, 95% CI (-7.886, -0.300), p=0.05

Causal Mediation Effect: 0.526, 95% CI (-0.661, 1.931), p=0.38

Table 14: Testing distance to city center as a potential moderator using individual level data

Variable	B	SE	Beta
Income over 45 days	-3.714	2.038	-0.272 [^]
Education	3.152	1.884	0.246
Food Insecurity	-2.163	2.785	-0.151
City Center	-0.485	2.411	-0.036
Food Insecurity X City Center	-2.680	3.096	-0.161
R square		0.149	

[^]p<0.10, *p<0.05

Table 15: Testing to the distance to the supermarket nearest to participants' home addresses as a potential moderator using individual level data

Variable	B	SE	Beta
Income over 45 days	-3.843	2.131	-0.282 [^]
Education	3.049	1.885	0.238
Food Insecurity	-3.312	2.042	-0.231
Supermarket	-0.152	2.024	-0.011
Food Insecurity X Supermarket	-1.339	1.877	-0.104
R square		0.143	
[^] p<0.10, *p<0.05			

Table 16: Testing to the distance to the public transportation stop nearest to participants' home addresses as a potential moderator using individual level data

Variable	B	SE	Beta
Income over 45 days	-2.996	1.957	-0.220
Education	2.031	1.851	0.158
Food Insecurity	-3.166	2.034	-0.221
Transportation	-2.912	1.900	-0.222
Food Insecurity X Transportation	3.763	2.178	0.248^
R square		0.210	

^p<0.10, *p<0.05

Table 17: Testing to the distance to the participant's pharmacy as a potential moderator using individual level data

Variable	B	SE	Beta
Income over 45 days	-1.461	2.111	-0.109
Education	3.575	1.938	0.280 [^]
Food Insecurity	-3.980	2.096	-0.291 [^]
Pharmacy	1.423	2.029	0.110
Food Insecurity X Pharmacy	-0.807	1.998	-0.060
R square		0.166	
[^] p<0.10, *p<0.05			

Table 18: Fixed effects and random effects estimates for multilevel model of any daily indicator of food insecurity predicting daily missed doses of medication

	Model 1		Model 2	
	Fixed Effects			
Parameter	B	SE	B	SE
Intercept	-2.254***	0.269	-2.362***	0.278
Level 1 (Daily Level Data)				
Day	0.017**	0.006	0.017**	0.007
Food Insecurity	-0.053	0.236	-0.090	0.245
Level 2 (Individual Level Data)				
Income Over 45 days			0.160	0.216
Education			-0.136	0.202
	Random Effects			
Intercept (σ^2)	2.415	1.554	2.431	1.559
Level 1 (Daily Level Data)				
Day	0.0004	0.019	0.003	0.017
Food Insecurity	0.010	0.098	0.021	0.143
Day*Food Insecurity	0.0001	0.010	0.0002	0.014
Standard errors and standard deviations are in parentheses; *p<0.05, **p<0.01, ***p<0.001				

Table 19: Fixed effects and random effects estimates for multilevel model of daily hunger predicting daily missed doses of medication

	Model 1		Model 2	
	Fixed Effects			
Parameter	B	SE	B	SE
Intercept	-2.323***	0.262	-2.458***	0.269
Level 1 (Daily Level Data)				
Day	0.016*	0.006	0.017**	0.007
Hunger	0.531*	0.265	0.57*	0.285
Level 2 (Individual Level Data)				
Income Over 45 days			0.131	0.207
Education			-0.162	0.200
	Random Effects			
Intercept (σ^2)	2.280	1.510	2.275	1.508
Level 1 (Daily Level Data)				
Day	0.0005	0.023	0.0005	0.022
Food	0.037	0.194	0.056	0.238
Day*Hunger	0.0001	0.014	0.0006	0.008
Standard errors and standard deviations are in parentheses; *p<0.05, **p<0.01, ***p<0.001				

Table 20: Fixed effects and random effects estimates for multilevel model with drinking (Yes/No) as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-2.627***	0.288
Level 1 (Daily Level Data)		
Day	0.19*	0.008
Hunger	0.673	0.474
Drinking (Yes/No)	0.731*	0.319
Drinking*Hunger	-1.919***	0.575
Day*Hunger	0.010	0.016
Day*Drinking	-0.003	0.012
Level 2 (Individual Level Data)		
Income Over 45 days	0.137	0.197
Education	-0.165	0.194
Random Effects		SD
Intercept (σ^2)	2.274	1.508
Level 1 (Daily Level Data)		
Day	0.001	0.025
Drinking*Hunger	0.298	0.546
*p<0.05, **p<0.01, ***p<0.001		

Table 21: Fixed effects and random effects estimates for multilevel model with number of drinks as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-2.036 [^]	1.059
Level 1 (Daily Level Data)		
Day	0.005	0.036
Hunger	-1.343	1.779
Number of Drinks	0.009	0.577
Number of Drinks*Hunger	0.100	0.706
Day*Hunger	0.008	0.033
Day*Number of Drinks	0.010	0.020
Level 2 (Individual Level Data)		
Income Over 45 days	-0.262	0.278
Education	0.013	0.281
Random Effects		
		SD
Intercept (σ^2)	3.976	1.994
Level 1 (Daily Level Data)		
Day	0.001	0.023
Number of Drinks*Hunger	0.280	0.529
[^] p<0.10		

Table 22: Fixed effects and random effects estimates for multilevel model with estimated blood alcohol concentration (eBAC) as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-1.223***	0.278
Level 1 (Daily Level Data)		
Day	0.015*	0.007
Hunger	-1.127	0.743
eBAC	-0.039	0.192
eBAC*Hunger	0.497	0.432
Day*Hunger	0.005	0.021
Day*eBAC	-0.001	0.006
Level 2 (Individual Level Data)		
Income Over 45 days	0.019	0.144
Education	0.071	0.132
Random Effects		
		SD
Intercept (σ^2)	1.108	1.053
Level 1 (Daily Level Data)		
Day	0.001	0.011
eBAC*Hunger	0.372	0.610
*p<0.05, **p<0.01, ***p<0.001		

Table 23: Fixed effects and random effects estimates for multilevel model with stressful events as a mediator

	Model of path a predicting stressors at follow-up		Model of path b and c' predicting medication adherence	
	Fixed Effects			
	B	SE	B	SE
Parameter				
Intercept	-0.035	0.018	-2.481***	0.279
Level 1 (Daily Level Data)				
Day	0.000	0.000	0.072**	0.208
Hunger	0.001	0.004	0.747*	0.321
Level 2 (Individual Level Data)				
Stressors at Baseline	0.372***	0.018	-0.249	0.219
Stressors at Follow-up			0.071	0.208
Income over 45 Days	-0.079***	0.019	0.041	0.217
Education	0.169***	0.019	-0.090	0.210
	Random Effects			
Intercept (σ^2)	0.018	0.000	2.436	1.560
Level 1 (Daily Level Data)				
Hunger	0.001	0.006	0.219	0.467
Day	0.000	0.032	0.000	0.022
Day*Hunger	0.004	0.064	0.000	0.007

Table 24: Fixed effects and random effects estimates for multilevel model reserve capacity as a mediator

	Model of path a predicting reserve capacity at follow-up		Model of path b and c' predicting medication adherence	
	Fixed Effects			
	B	SE	B	SE
Parameter				
Intercept	-0.029**	0.011	-2.393***	0.267
Level 1 (Daily Level Data)				
Day	0.000	0.000	0.016*	0.007
Hunger	0.000	0.000	0.142	0.442
Hunger*Day	0.000	0.000	0.009	0.015
Level 2 (Individual Level Data)				
Reserve Capacity at Baseline	0.839***	0.011	-0.264	0.350
Reserve Capacity at Follow-up			0.090	0.357
Income over 45 Days	-0.027*	0.012	0.208	0.194
Education	-0.047***	0.012	-0.209	0.193
	Random Effects			
Intercept (σ^2)	0.007	0.083	2.209	1.486
Level 1 (Daily Level Data)				
Day	0.000	0.000	0.001	0.023

Table 25: Fixed effects and random effects estimates for multilevel model of hunger with emotion as a mediator

Parameter	Model of path a predicting emotion at follow-up		Model of path b and c' predicting medication adherence	
	Fixed Effects			
	B	SE	B	SE
Intercept	-0.028*	0.015	-2.441***	0.276
Level 1 (Daily Level Data)				
Day	0.000	0.000	0.017*	0.007
Hunger	-0.008	0.007	0.320	0.531
Level 2 (Individual Level Data)				
Emotion at Baseline	0.705***	0.016	-0.461^	0.278
Emotion at Follow-up			0.164	0.317
Income over 45 Days	0.010	0.016	0.180	0.210
Education	-0.104***	0.016	-0.218	0.212
	Random Effects			
Intercept (σ^2)	0.013	0.113	2.319	1.523
Level 1 (Daily Level Data)				
Day	0.000	0.000	0.000	0.021
Hunger	0.001	0.037	0.027	0.164
Hunger*Day	0.000	0.009	0.000	0.011

Table 26: Path estimates of a multilevel structural equation model with day-level data

Paths	B	SE	p-value
Hunger -> Missed Dose	2.137	0.862	0.013
Hunger -> Emotion	0.745	0.555	0.180
Hunger -> Stressful Events	3.290	0.897	<0.001
Hunger -> Reserve Capacity	-9.067	2.027	<0.001
Reserve Capacity -> Emotion	0.632	0.022	<0.001
Stressful Events -> Emotion	0.013	0.032	0.675
Stressful Events -> Missed Dose	0.086	0.098	0.382
Reserve Capacity -> Missed Dose	0.327	0.228	0.152
Emotion -> Missed Dose	-0.454	0.349	0.193
Income Over 45 Days -> Missed Dose	0.250	0.214	0.241
Education -> Missed Dose	-0.341	0.235	0.146
Missed Dose <-> Slope of Day->Missed Dose	-0.017	0.012	0.146
Income -> Slope	-0.001	0.006	0.874
Education -> Slope	0.003	0.006	0.612
Stressful Events -> Slope	-0.004	0.003	0.101
Reserve Capacity -> Slope	-0.003	0.005	0.549
Emotion -> Slope	0.003	0.008	0.706
Intercepts			
Stressful Events	2.636	0.340	<0.001
Reserve Capacity	1.186	0.496	0.017
Emotion	-0.134	0.133	0.315
Slope	0.031	0.011	0.004

Table 27: Fixed effects and random effects estimates for multilevel model with distance between participant's home address and Atlanta's city center as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-2.753***	0.311
Level 1 (Daily Level Data)		
Day	0.022**	0.007
Hunger	0.581^	0.324
City Center*Hunger	0.238	0.348
Level 2 (Individual Level Data)		
Distance to City Center	-0.204	0.214
Income Over 45 days	0.037	0.195
Education	-0.392*	0.196
Random Effects		
		SD
Intercept (σ^2)	2.274	1.508
Level 1 (Daily Level Data)		
Hunger	0.434	0.659
Day	0.000	0.018
Day*Hunger	0.001	0.035
^p<0.10, *p<0.05, **p<0.01, ***p<0.001		

Table 28: Fixed effects and random effects estimates for multilevel model with distance between participant's home address and nearest supermarket as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-2.58***	0.284
Level 1 (Daily Level Data)		
Day	0.020**	0.006
Hunger	0.250	0.497
Supermarket*Hunger	0.114	0.245
Day*Hunger	0.002	0.017
Level 2 (Individual Level Data)		
Distance to Supermarket	0.009	0.211
Income Over 45 days	0.307	0.208
Education	-0.319	0.198
Random Effects		
		SD
Intercept (σ^2)	2.274	1.508
Level 1 (Daily Level Data)		
Day	0.000	0.018
^p<0.10, *p<0.05, **p<0.01, ***p<0.001		

Table 29: Fixed effects and random effects estimates for multilevel model distance between participant's home address and nearest public transportation stop as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-2.58***	0.284
Level 1 (Daily Level Data)		
Day	0.021**	0.503
Hunger	0.273	0.502
Transportation*Hunger	-0.056	0.259
Day*Hunger	0.001	0.017
Level 2 (Individual Level Data)		
Distance to Transportation	0.222	0.193
Income Over 45 days	0.302	0.195
Education	-0.292	0.196
Random Effects		
		SD
Intercept (σ^2)	2.264	1.505
Level 1 (Daily Level Data)		
Day	0.001	0.014
^p<0.10, *p<0.05, **p<0.01, ***p<0.001		

Table 30: Fixed effects and random effects estimates for multilevel model with distance between participant's home address and participant's pharmacy as a moderator

Fixed Effects		
Parameter	B	SE
Intercept	-2.575***	0.302
Level 1 (Daily Level Data)		
Day	0.019**	0.007
Hunger	0.602*	0.285
Pharmacy*Hunger	0.082	0.266
Level 2 (Individual Level Data)		
Distance to Pharmacy	0.068	0.230
Income Over 45 days	0.065	0.199
Education	-0.334	0.207
Random Effects		
		SD
Intercept (σ^2)	2.115	1.454
Level 1 (Daily Level Data)		
Hunger	0.369	0.608
Day	0.001	0.013
Day*Hunger	0.001	0.037
^p<0.10, *p<0.05, **p<0.01, ***p<0.001		

Figure 1: Screening and enrollment into the observational study

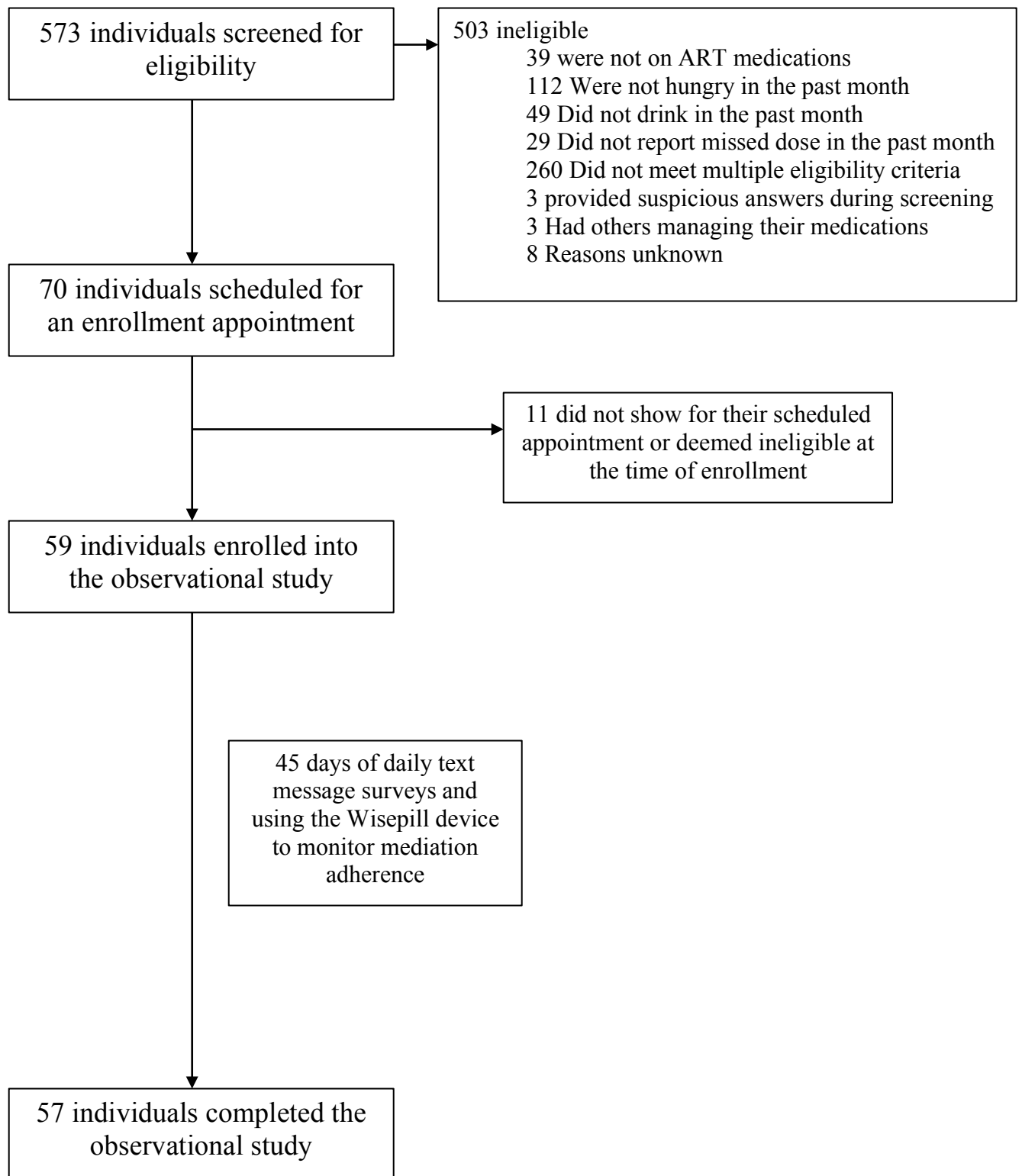


Figure 2: Structural equation model using individual level data

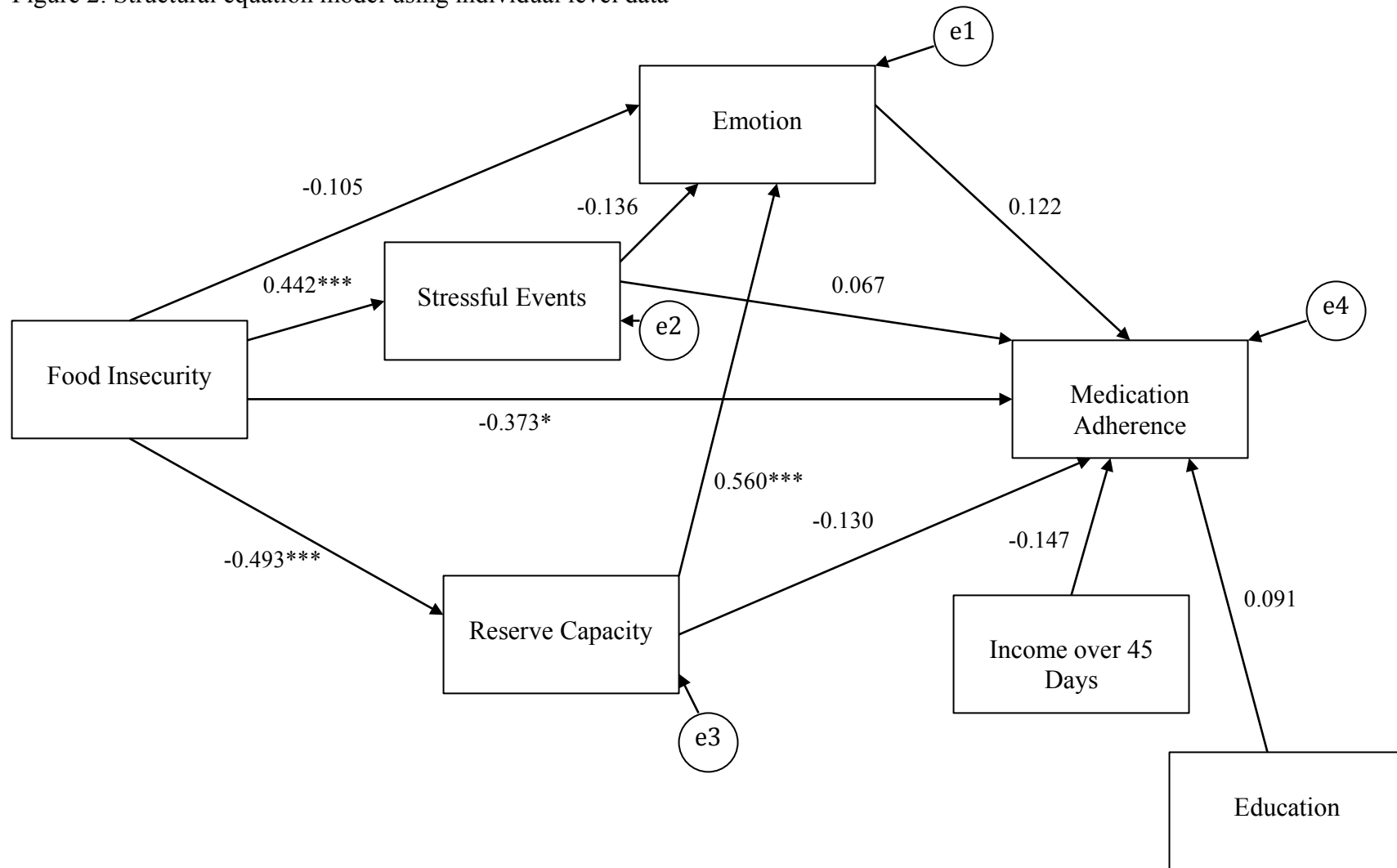
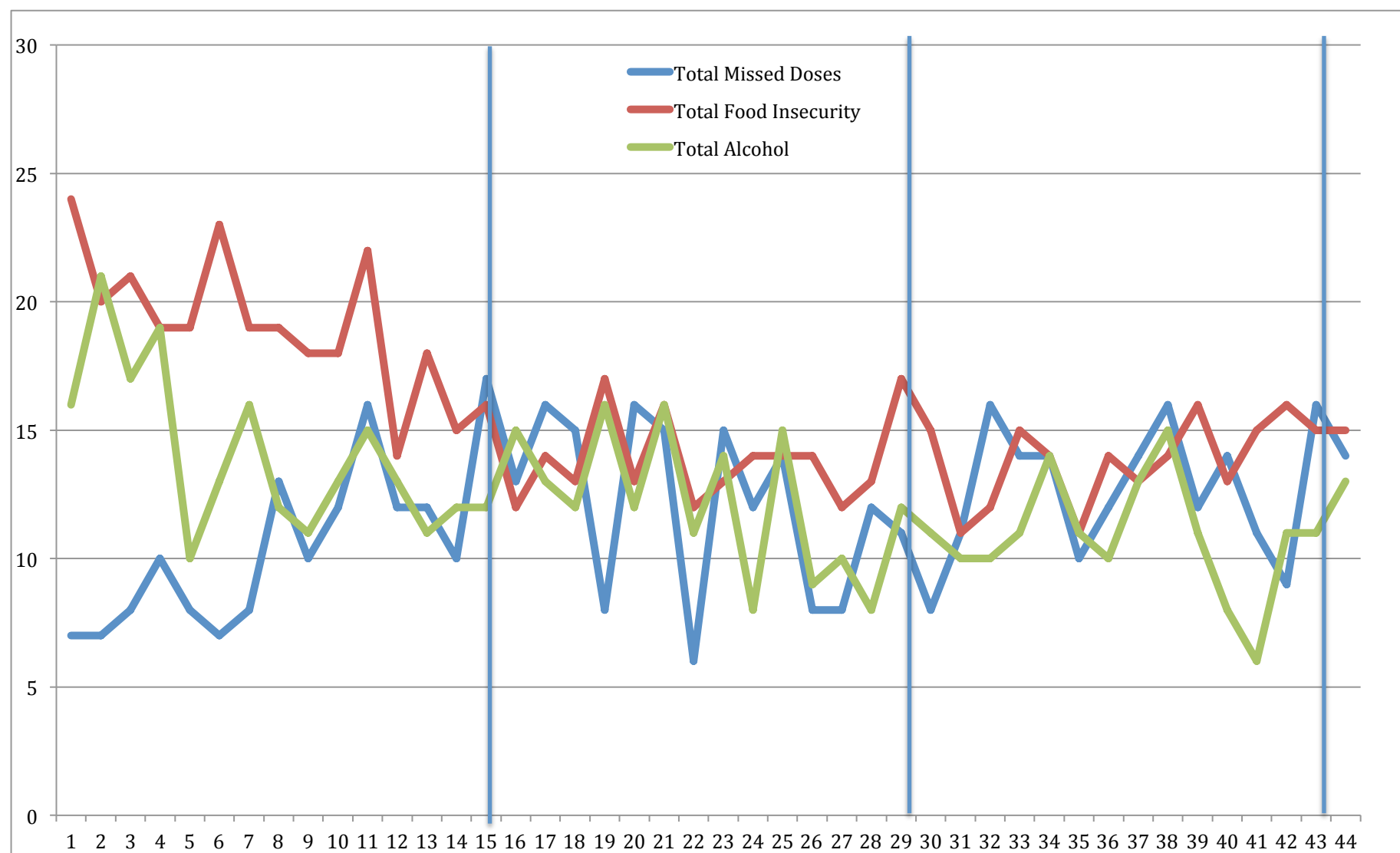


Figure 3: Time Trends of Daily Day with Study Payments Marked (Days 15, 29, 43)



Note: Each line represents the total number of events that occurred each day across participants

Figure 4: The daily interaction between hunger and drinking on missed doses of medication

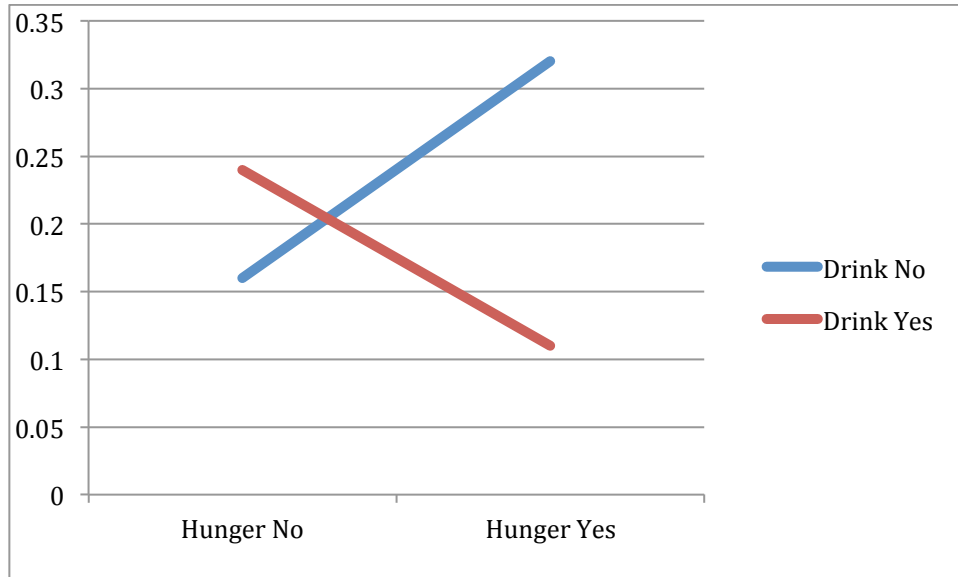
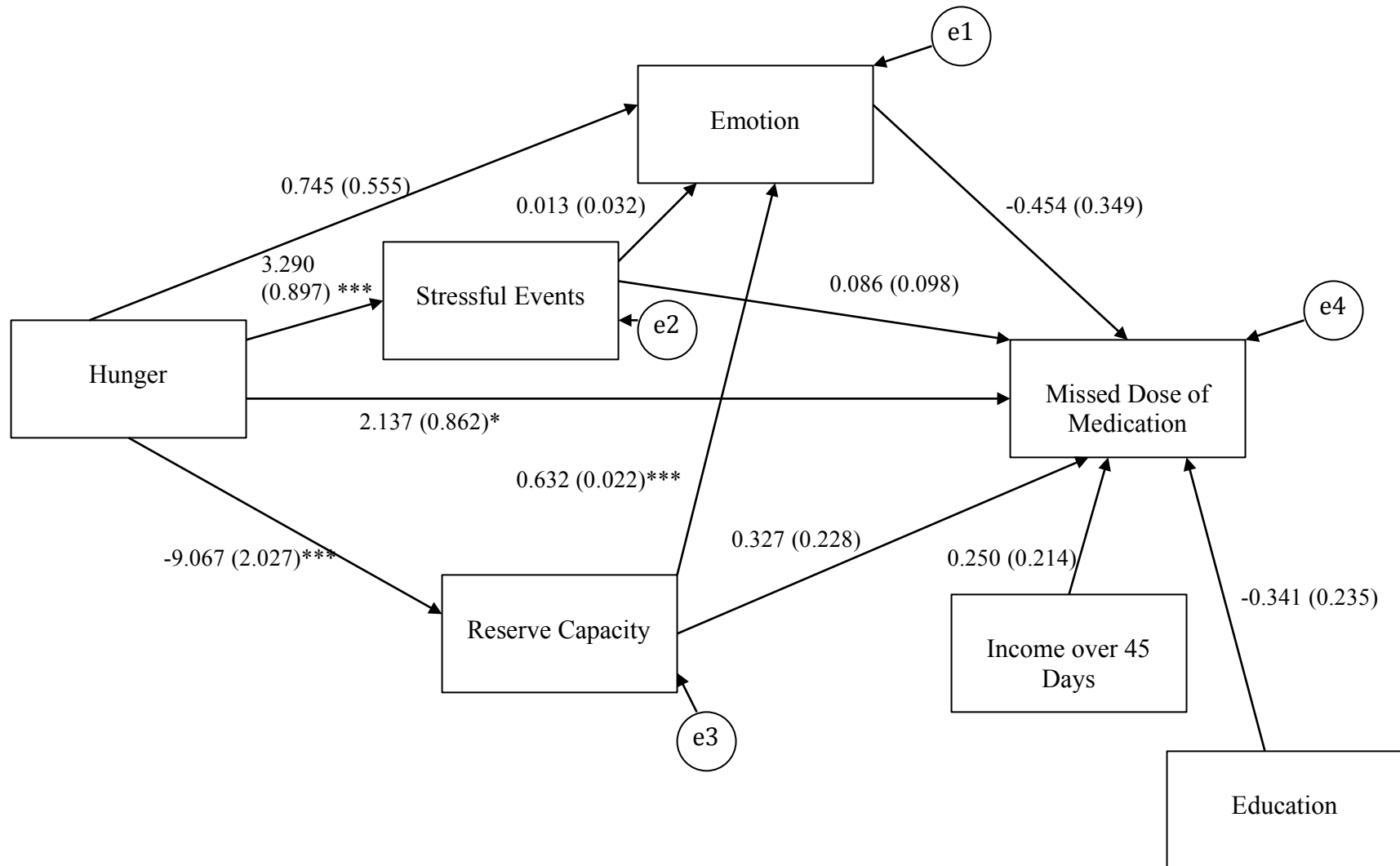


Figure 5: Multilevel structural equation model using day level data



Appendix A: Conceptual Frameworks Discussed

Figure 2 from Pellowski, Kalichman, Matthews, and Adler (2013) proposing a framework to explain health disparities in HIV across the lifespan

Figure 2
A Health Disparities Framework for HIV/AIDS

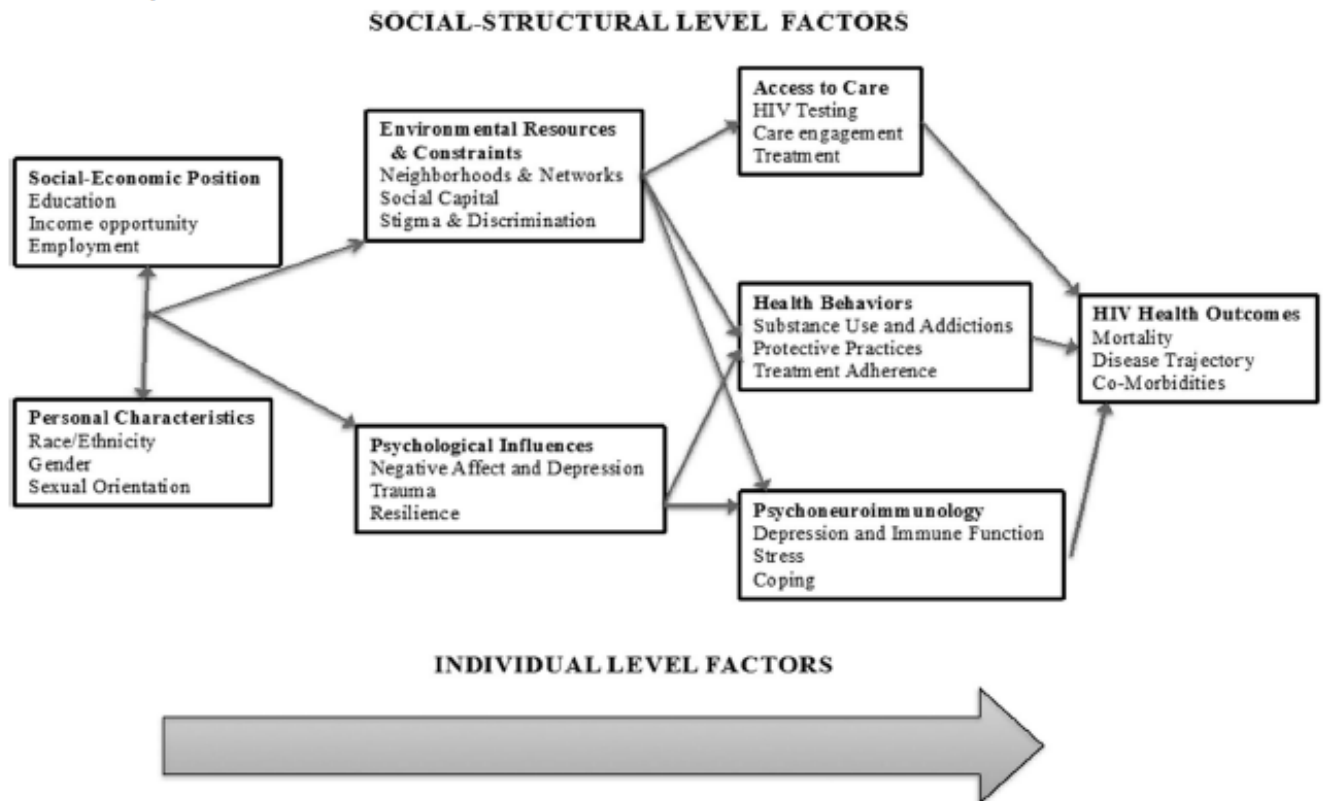


Figure 3 from Weiser et al. (2011) showing the conceptual pathways in which food insecurity is related to ART non-adherence

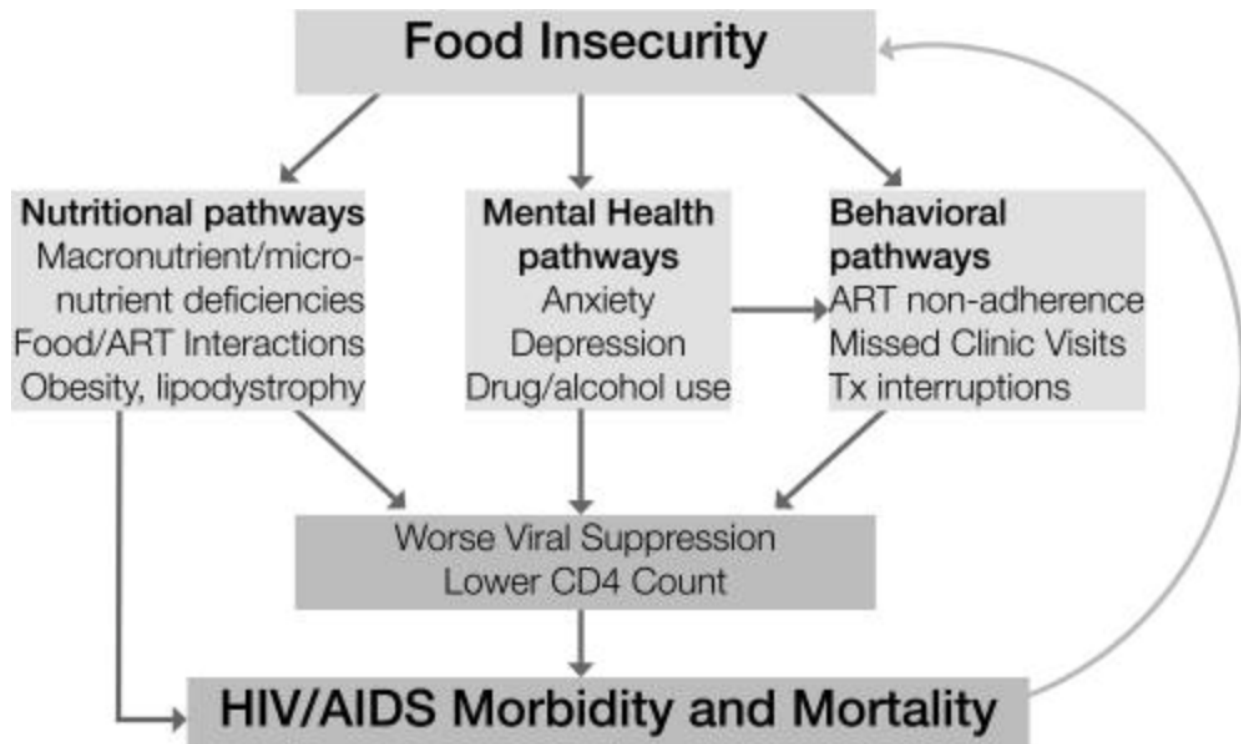
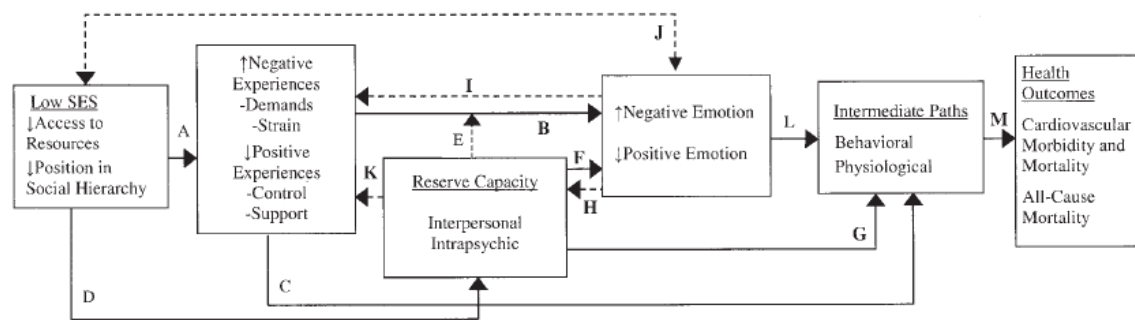


Figure 1 from Gallo & Matthews (2003) showing the conceptual pathways of the Reserve Capacity Model



Appendix B: Screening Instrument

Screening Script

“Thank you for calling the SHARE Project. The SHARE Project is a research group that conducts a variety of health related research studies in Atlanta. In order to see if you qualify for a study, I need to ask you a few questions. Is that okay?” Upon affirmation the Screener continues.

“Have you ever called the SHARE Project to get information about studies before?”
If No, the Screener will ask all caller the Screening Questions.

If a caller indicates that they have called before, the Screener will ask:

“Can you tell me your initials and date of birth?” The Screener will search Unique Identifier for a matching record. The Screener will verify if the caller has screened for all studies that are currently enrolling. If a new study is available, the Screener will ask the screening questions.

General screening

Have you been in a SHARE Project study before?

How did you hear about us?

How old are you?

What is your race?

What is your gender?

What is the highest grade you completed in school?

What is your HIV status?

If HIV+ screen for Daily Study

Daily Study Screening

Are you currently in a partnered relationship?

Do you smoke tobacco? (foil)

What is your current weight? (foil)

When was the last time you drank any alcohol?

When was the last time you were hungry but could not eat because you couldn't afford food?

Do you live in a residential facility – alcohol, drug, mental health treatment facility?

Are you currently prescribed HIV medications?

How many times have you missed taking any of your HIV medications in the past month?

Does anyone assist you with taking your HIV medications?

What is the last time you had sex- either anal or vaginal? (Another study)

When is the last time you rode MARTA – train or bus? (foil)

What is the last time you visited you HIV doctor? (foil)

Appendix C: Consent Form

11-22-14 V3

Study ID _____



Consent Form for Participation in a Research Study

Principal Investigator: Seth Kalichman, PhD

Study Title: The Daily Study

Introduction

You are invited to take part in a health-related research study. The study will look at the impact of psychosocial factors on medication adherence.

Why is this study being done?

The reason for this study is to understand what psychosocial factors impact medication adherence of people living with HIV.

What are the study procedures? What will I be asked to do?

Today your office appointment will be approximately 90 minutes.

Today you will:

1. VIRAL LOAD AND CD4 REPORT

You will be asked to provide the SHARE Project with a chart abstracted HIV Viral Load and CD4 Cell Report. This report will only be identified with your Study ID and not your name.

2. OFFICE COMPUTER ASSESSMENT

You will be asked to answer questions on a computer. The questions will ask you about your health, medication, access to food and alcohol use. You do not have to answer any questions that you do not want to answer. Your name will not appear anywhere in the computer survey. You will only be known by a number. The computer survey will take between 30-45 minutes to complete.

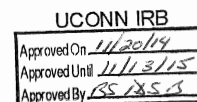
3. WEIGHT AND HEIGHT MEASUREMENT

You will be asked to step on a scale in your bare feet. The scale will determine your height, weight, percent of body fat mass, fat-free mass, estimated muscle mass, total percent of body water, basal metabolic rate and body mass index (BMI). BMI is calculated from your weight and height and helps to understand if you are underweight, over-weight or of normative weight for someone in the United States.

You will be asked if you have any metal implants, such as a pace maker or joint replacement. If you have such a device your weight will be obtained using a conventional scale.

TEXT MESSAGE SURVEY

You will be asked to complete 45 days of daily text message surveys. The text message survey will ask you questions about nutrition and alcohol use. You will be provided with the phone and service in order to complete the daily text message survey. The schedule for receiving text message surveys will be provided to you. If you have problems completing the text message survey, you may call the number provided for assistance. Each day it will take you approximately 5 minutes to complete the text message survey.



WISEPILL ELECTRONIC PILLBOX

You will be asked to use a Wisepill electronic pillbox to hold your HIV medications for the length of the study (45 days). This electronic pillbox sends a signal every time that you open it. The signal simply indicates the time and date of the opening. This time and date information is only accessible by SHARE Project research staff. There is a green light on the side of the device that will light up when you open the pillbox. This is normal and indicates that the message has been sent. The Wisepill electronic pillbox will be completely charged when you receive it and will not need to be charged while it's in your possession. You may refill your Wisepill with your medications whenever you need to.

SHARE PROJECT CELL PHONE

You will be provided with a SHARE Project cell phone to use to complete all of your text message surveys. This phone will be locked with a code so that you may only send and receive calls/text to the numbers that are preprogrammed in the phone.

If you lose this phone or it is stolen, another one will be provided to you at no cost. Please notify the SHARE Project Office as soon as you realize that the phone is lost or stolen in order that arrangements may be made for you to receive another one.

If it is determined that you have unlocked the code which locks the phone and you have used the SHARE Project Cell Phone for any other purpose than what it was provided for, you will be removed from the study and will not be allowed to complete any other study activities.

You will be asked to return the phone at the end of the study. The phones cannot be used for any other purposes.

PREVIOUS STUDIES

You will be asked to give your permission to allow the researchers to look at surveys you completed in earlier studies. Your previous surveys and other sources of data will be identified by matching up your unique code number with other previous surveys.

What other options are there?

You have the option not to participate. You do not have to be in this study if you do not want to. You can change your mind and drop out later if you want to. No one will be mad at you if you do.

What are the risks or inconveniences of the study?

You will be asked to complete interviews and surveys that include sensitive topics about your health and your medications.

- By coming to the SHARE Project office it is possible others could find out that you are living with HIV/AIDS.
- Having to come to the SHARE Project office may be inconvenient and may require you to get transportation and other forms of assistance to participate.
- Having to complete text message surveys for 45 days may be inconvenient.
- Some of these questions may make you uncomfortable or cause you to become upset. You do not have to answer any question that you do not want to and you can stop participating at any time. If you become distressed, we will have someone for you to talk with.
- Having to use the Wisepill electronic pillbox to hold your medications for 45 days may be inconvenient.
- The total time to complete the study will be as much as 6 hours.

UCONN IRB	
Approved On	11/20/14
Approved Until	11/13/14
Approved By	RS/DSE

What are the benefits of the study?

- You understand that the information that you give us may be useful for others living with HIV/AIDS.

Will I receive payment for participation? Are there costs to participate?

For your time commitment to our project you will be compensated for each time you complete a study activity. You will receive:

Transportation Assistance Today	\$10 (cash)
Initial Office Visit	\$30
Text Message Surveys (\$2 x 45 days)	\$90
Return the Wisepill electronic pillbox	\$25
Provide VL/CD4 Report	\$20
Follow-up Appointment	<u>\$20</u>
Total possible compensation	\$195

All other study incentive payments after will be deposited onto the Bank of America Card (BOA) that you will receive. The incentive payments will be placed on your card at scheduled times during the 45 day study. You will be provided with the dates of the deposits. If your BOA Card is lost or stolen, you will be responsible for the \$15 fee that is charged by Bank of America to replace the card.

How will my personal information be protected?

Only the researchers will have access to the information you provide.

We cannot protect your confidentiality if...

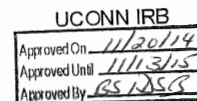
- we discover that you plan to cause serious harm to yourself or others.
- you tell us that you have a plan to have high-risk sex with a named person who does not know you are HIV positive. We may be legally required to protect that person.

Your name will not be put on any of your surveys.

- You will be given a secret code number. The list linking your secret code to any of your information will be kept separate. The list will be destroyed within 6- months of completion of the study.
- Your name will not appear in any publication. Your name will not be given to anyone else without your written consent.

During the course of the study you may receive calls from SHARE Project staff members. Prior to beginning a conversation the SHARE Project staff member will verify your identity by asking you to answer two security questions- "Where were you born?" and "What is your mother's first name?"

If a SHARE Project staff member calls a number that you have provided, a message will only be left on an answering machine or with the person who answers if you have given permission for messages to be left at that number. You will only receive emails or text message reminders if you have given the SHARE Project staff permission to contact you via email or text messaging.



You should also know that the UConn Institutional Review Board (IRB) and the Office of Research Compliance may inspect study records as part of its auditing program, but these reviews will only focus on the researchers and not on your responses or involvement. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

To help us protect your privacy, the Investigator has applied for a Confidentiality Certificate from the Department of Health and Human Services.

- The Confidentiality Certificate says that the investigators cannot be forced (for example by court subpoena) to give information that may identify you in any federal, state, or local civil, criminal, administrative, legislative, or other proceedings.
- We will only have to tell information if it is requested by the Department of Health and Human Services for an audit or evaluation.
- You should know that a Confidentiality Certificate does not stop you or your family members from giving information telling others about yourself that you are participating in this research. This means that you and your family must also protect your own privacy.
- We cannot protect your confidentiality if we discover that you plan to cause serious harm to yourself or others.

Can I stop being in the study and what are my rights?

You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

You will be notified of all significant new findings during the course of the study that may affect your willingness to continue.

Who do I contact if I have questions about the study?

Take as long as you like before you decide. We will answer any question you have about this study. You may call Chauncey Cherry, the Project Director in Atlanta (860) 208-1760 or the Principal Investigator, Seth Kalichman (860) 486-8702 (collect) if you have questions about this project. You may also call the University of Connecticut Institutional Review Board (IRB) at 860-486-8802. They can answer any question about your rights as a research subject.

Documentation of Consent:

I have read this form and decided that I will participate in the project described above. Its general purposes, the particulars of involvement and possible hazards and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time. My signature also indicates that I have received a copy of this consent form.

Participant Name (printed)

Date of Birth

Signature of Participant

Today's Date

Signature of Person Obtaining Consent

Today's Date

UConn IRB	
Approved On	11/26/14
Approved Until	11/13/15
Approved By	BS/SSS

Appendix D: The Wisepill Device: Description and Previous Research

The Wisepill device (Wisepill Technologies, Somerset West, South Africa) is an electronic pillbox that holds 30 large pills or 60 small pills. When the Wisepill device is opened,



a date and time stamp is created which is then sent to a central server via general packet radio services (GPRS). This information is then accessible via a secure, internet-based interface. If there is a lapse in cellular signal, the Wisepill

device will hold the date and time stamp information until it can send the data. The battery lasts approximately three months when fully charged.

Although this device is relatively new, it has been used in several previous research studies. Haberer et al. (2010) conducted the first HIV medication adherence study with the Wisepill device. These researchers conducted an observational pilot study that compared adherence assessed by the Wisepill device, unannounced pill counts and self-report with ten adults living with HIV in Uganda. Haberer et al. (2010) found that the Wisepill adherence was similar to adherence assessed with another form of electronic medication monitoring MEMSCap (Medication Event Monitoring System; used for the 3 months prior to the start of the study). Wisepill adherence was lower than self-reported medication adherence, assessed using a 30-day visual-analog scale (VAS) and a 3-day self-reported recall of missed doses. Additionally, the

Wisepill adherence was also lower than adherence assessed using unannounced pill counts. Significance testing could not be assessed because of the small sample size. Haberer et al. (2010) also assessed the acceptability of the device. Participants reported that the Wisepill device was easy to use and convenient. From this study, researchers deemed the Wisepill feasible to use for real-time adherence monitoring, particularly for resource-limited settings.

The Wisepill device was also used in a study conducted in China among HIV positive injection drug use patients (Bachman Desilva et al., 2013). Bachman Desilva et al. (2013) found that adherence assessed by the Wisepill device was similar to adherence assessed via self-report (i.e. VAS; 97.2% vs. 98.5%). Researchers also found generally positive acceptability of the device, with participants reporting that the device was easy to use and were willing to participate in another study using the device. This study, however, did find some negatives about the device including concerns about disclosure of their HIV status due to using the device. One participant felt that the device was inconvenient to care and one participant did not like the feeling of being watched while using the device.

The Wisepill device has also been used in two interventions, one in China (Sabin et al., *in press*) and one in Atlanta, GA (Pellowski et al., 2014). The intervention conducted in China used the Wisepill device to trigger real time text message reminders when participants were late taking their doses of medication (Sabin et al., *in press*). The control condition did not receive any reminders. Sabin et al. (*in press*) found that participants in the intervention condition had significantly higher adherence over 6 months than those in the control condition.

I also utilized the Wisepill device for an adherence intervention for my Master's Thesis (Pellowski et al., 2014). In this small scale randomized controlled trial, participants in the intervention condition received triggered just-in-time counseling, such that when participants

were late taking their doses of medication, a counselor called them to counsel them on their in-the-moment barriers to taking their medication. Unfortunately, there were a high number of uncompleted counseling calls. It is likely that missed doses of medication occurred at times that were least amenable to answering counseling calls, such as participants being busy at the time, asleep, or intoxicated (Pellowski et al., 2014). Acceptability was also measured in this study and we found that, in general, participants found the device convenient and they liked using the device. However, almost half of the participants in this study felt uncomfortable being monitored.

In conclusion, the Wisepill device has been shown to be useful in a variety of settings, including resource poor and resource rich countries. Although there are some participant concerns present across several of the studies regarding feelings of discomfort while using the device, in general, participants tend to like using the Wisepill device and they find it convenient to use. Although there is no definitive evidence regarding the accuracy of the Wisepill device as a way of assessing medication adherence, in general, the studies that report on this find adherence assessed by Wisepill to be similar to other forms of electronic monitoring (i.e. MEMS; Haberer et al., 2010) and self-report (i.e. VAS; Bachman Desilva et al., 2013).

Appendix E:
Decision Tress for which ARV to put in Wisepill Device

Once participants are enrolled into the Daily Study, which ARV the participant should place in the Wisepill Device should be determined using the following decision tree:

Medications taken 2 or more times per day

Aptivus (PI)
Combivir (NRTI)
Crixivan (PI)
Epivir (NRTI)
Intelence (NNRTI)
Invirase (PI)
Isentress (Integrase inhibitor)
Kaletra (PI)
Lexiva (PI)
Prezista (PI)
Rescriptor (NNRTI)
Retrovir (NRTI)
Selzentry (Entry Inhibitor)
Tivicay (Integrase inhibitor)
Trizivir (NRTI)
Videx EC (NRTI)
Viracept (PI)
Zerit (NRTI)
Ziagen (NRTI)

If the participant isn't taking any of these, then:

Medications that have prescribed to be taken with food.

Complera (single tablet regimen)
Edurant (NNRTI)
Prezista (once daily; PI)
Reyataz (PI)
Stribild(single tablet regimen)

If the participant isn't taking any of these, then:

Medications that contain 2 or more medications in one tablet

Atripla

If the participant isn't taking any of these, then:

Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs)

Sustiva
Viramune

If the participant isn't taking any of these, then:

Nucleoside Reverse Transcriptase Inhibitors (NRTIs)

Emtriva
Epivir (once daily)
Epzicom
Truvada

Viread

Ziagen (once daily)

If the participant isn't taking any of these, then:

Any other ART medication

Protease Inhibitors:

Kaletra (once daily)

Lexiva (once daily)

Appendix F: Full ACASI Assessment

Calculated Variable

TODAY

TODAY = Today's date

Calculated Variable

START

start time

START = Current time

Calculated Variable

WKAGO6

6 Weeks Ago

WKAGO6 = SHORTDATE(TODAY-45)

Calculated Variable

MOAGO1

6 Weeks Ago

MOAGO1 = SHORTDATE(TODAY-45)

Calculated Variable

MOAGO3

3 MONTH AGAO

MOAGO3 = SHORTDATE(TODAY-90)

Q1.

Which assessment is the participant completing?

ASSESSA

ASSESS

1

0 = Daily Study Follow Up Only

1 = Daily Study Follow Up and RCS Baseline

Q2.

Staff Name

STAFFA

staff administering assessment

1

0 = Sabrina

1 = Moira

2 = Chauncey

3 = Christopher

4 = Other

8 = Refuse to Answer

Q3.

Enter Staff Name

STAFF1A

Enter "other" staff

20

Q4.

Subject ID

SUBJECT

SUBJECT ID

5

1 - 10000 = range

1 = Yes
8 = Refuse to Answer

TRANSPD Practice-transportation: A friend dropped me off. 1

0 = No
1 = Yes
8 = Refuse to Answer

TRANSPOE Practice-transportation: I walked. 1

0 = No
1 = Yes
8 = Refuse to Answer

TRANSPOF Practice-transportation: None of the above. 1

0 = No
1 = Yes
8 = Refuse to Answer

Q10. Some questions will simply ask you to answer Yes or No. For example:

Have you used a computer in the past 2 months?

TOUCH Yes or No. The computer will automatically move on to the next question.

COMPA Practice-used computer 1

0 = No
1 = Yes
8 = Refuse to Answer

Q11. When were you born - your date of birth?

DOBA DOB 8

1/1/1920 - 1/1/1996 = mm/dd/yyyy
2098 = Refuse to Answer (Year)

Q12. What is the zip code where you live?

ZIPCODEA zipcode 5

0 - 99888 = range
99998 = Refuse to Answer

Q13. Which best describes you?

RACEA Race 1

1 = White
2 = African-American/Black
3 = Hispanic/Latino
4 = Asian/Pacific Islander
5 = other

8 = Refuse to Answer

Q14. Do you identify as a transgender person? A transgender person is a biological man who feels as a woman or a biological woman who feels as a man.

TRANSA gender identified as

1

0 = No

1 = Yes

8 = Refuse to Answer

Q15. What is your gender?

If you identify as Transgender, please indicate if you would like to complete a survey for a Male or a Female.

GENDERA Gender

1

1 = Male

2 = Female

8 = Refuse to Answer

Q16. How would you describe your sexual orientation?

ORIENTA Sexual orientation

1

1 = Gay/Homosexual/Same Gender Loving

2 = Bisexual

3 = Straight/Heterosexual

8 = Refuse to Answer

Q17. What is the highest grade or year of school that you completed?

EDUCA Education

2

6 = 6th grade

7 = 7th grade

8 = 8th grade

9 = 9th grade

10 = 10th grade

11 = 11th grade

12 = 12th grade

13 = Graduate Equivalency Degree or GED

14 = Some College

15 = Completed College

98 = Refuse to Answer

Q18. What is your current employment status?

EMPLOYA employment

1

0 = Working Full Time

1 = Working Part Time

2 = Disability

3 = Unemployed

4 = Student

5 = Other

8 = Refuse to Answer

Q19. Which ONE is closest to your yearly income?

INCOME A income

1

1 = \$0-\$10,000

2 = \$11,000-\$20,000

3 = \$21,000-\$30,000

4 = Over \$30,000

8 = Refuse to Answer

Q20. Have you ever been incarcerated or in jail?

JAIL A Jail

1

0 = No

1 = Yes

Q21. How many times have you stayed overnight in the hospital due to HIV or AIDS?

HOSPA hospital time for HIV

1

0 = 0

1 = 1

2 = 2

3 = 3

4 = 4

5 = 5+ times

8 = Refuse to Answer

Q22. How many times have you stayed overnight in a hospital or treatment center for alcohol or drug use?

SUBHOSPA hospital time for substances

1

0 = 0

1 = 1

2 = 2

3 = 3

4 = 4

5 = 5+ times

8 = Refuse to Answer

Q23. Have you ever received medication to help with your nerves or moods, including depression?

MHSVCA Mental Health Service

1

0 = No

1 = Yes

8 = Refuse to Answer

Q24. Have you ever received treatment for drinking too much alcohol?

ALCSVCA Alc Treat

1

0 = No

1 = Yes

8 = Refuse to Answer

Q25. Have you ever attended Alcoholics Anonymous (AA)?

AASVCA AA

1

0 = No

1 = Yes

8 = Refuse to Answer

Q26. Have you ever received treatment for using drugs?

DRUGSVCA Drug Treat

1

0 = No

1 = Yes

8 = Refuse to Answer

Q27. Have you ever attended Narcotics Anonymous (NA)?

NASVCA NA

1

0 = No

1 = Yes

8 = Refuse to Answer

Q28. When did you first test HIV positive? If you are unsure of the exact date, please take your best guess.

TESTPOS HIV Date

6

1/1980 - Current = mm/yyyy

2098 = Refuse to Answer (Year)

Q29. Where did you test HIV Positive?

TESTPOS1 Where test pos

1

1 = Atlanta

2 = In Georgia, but not in the Atlanta area

3 = Outside of the state of Georgia

8 = Refuse to Answer

Q30. What is your most recent T-Helper (CD4) cell count?

CD4A CD4 count

4

0 - 5000 = range

9997 = Don't Know

Q31. Was your most recent Viral Load test Detectable or Undetectable?

VIRALA viral load det/undetec

1

1 = Detectable

2 = Undetectable

3 = Don't Know

Q32. Are you CURRENTLY taking anti-HIV medications such as Atripla, Truvada, Kaletra, AZT etc?

- ARVA** HIV meds 1
- 0 =** No
1 = Yes
8 = Refuse to Answer
- Q33. In the past 6 weeks, did you run out of your HIV medications before you could get a refill?**
- MED1A** out of meds 1
- 0 =** No
1 = Yes
8 = Refuse to Answer
- Q34. Thinking about the past 6 weeks or since [MOAGO1], what percent of your HIV medications have you taken? Click anywhere on the line till you see your correct response in the box below the line. After you see the correct response, click NEXT QUESTION.**
- VASA** visual analog scale 3
- 0 =** 0%
1 - 99 = unlabelled scale points
100 = 100%
998 = Refuse to Answer
- Q35. My health, at present, depends on my HIV medicines.**
- MEDV1A** Health depends on meds 1
- 1 =** Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q36. Having to take medicines worries me.**
- MEDV2A** Taking meds worry 1
- 1 =** Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q37. My life would be impossible without my HIV medicines.**
- MEDV3A** Life impossible without meds 1
- 1 =** Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree

8 = Refuse to Answer

Q38. Without my HIV medicines, I would be very ill.

MEDV4A Without meds ill

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q39. I sometimes worry about long-term effects of my HIV medicines.

MEDV5A Long term effects worry

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q40. My medicines are a mystery to me.

MEDV6A Meds mystery

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q41. My health in the future will depend on my HIV medicines.

MEDV7A Future health depends meds

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q42. My HIV medicines disrupt my life.

MEDV8A Meds disrupt life

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

- Q43. I sometimes worry about becoming too dependent on my medicines.**
MEDV9A Dependent on meds 1
- 1** = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q44. My HIV medicines protect me from becoming worse.**
MEDV10A Meds protect 1
- 1** = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q45. I tend to hide from people the fact that I am taking HIV medications.**
HIDEA hide medications 1
- 1** = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q46. Patients have sometimes been deceived or misled by healthcare providers.**
TRUST7A Trust7 1
- 1** = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q47. When healthcare providers make mistakes they usually cover it up.**
TRUST10A Trust10 1
- 1** = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q48. Healthcare providers have sometimes done harmful things to patients without their knowledge.**

TRUST11A Trust11

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q49. People of my race cannot trust doctors and health care workers.

TRUST13A Trust13

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q50. People of my race should be suspicious of information from doctors and health care workers.

TRUST14A Trust14

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q51. People of my race should not confide in doctors and health care workers because it will be used against them.

TRUST15A Trust15

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q52. People of my race should be suspicious of medicine.

TRUST16A Trust16

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q53. Doctors and health care workers treat some people of my race like guinea pigs.

TRUST17A Trust17

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q54. Doctors and health care workers do not take the medical complaints of people of my race seriously.

TRUST18A Trust18

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q55. People of my race are treated the same as people of other groups by doctors and health care workers.

TRUST19A Trust19

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q56. People of my race receive the same medical care from doctors and health care workers as people from other groups.

TRUST20A Trust20

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q57. In most hospitals, people of my race don't receive as good of care as people of other races.

TRUST21A Trust21

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q58. My doctor is usually considerate of my needs and puts them first.

TRUST1A Trust1

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q59. I trust my doctor so much I always try to follow his/her advice.

TRUST2A Trust2

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q60. I sometimes distrust my doctor's opinions and would like a second one.

TRUST3A Trust3

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q61. If my doctor tells me something is so, then it must be true.

TRUST4A Trust4

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q62. I trust my doctor's judgments about my medical care.

TRUST5A Trust5

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q63. I trust my doctor to tell me if a mistake was made about my treatment.

- TRUST6A** Trust6 1
- 1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q64. I trust that my healthcare providers are giving me the best treatment available.**
- TRUST8A** Trust8 1
- 1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q65. I trust that my healthcare providers have my best interest in mind when treating me.**
- TRUST9A** Trust9 1
- 1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q66. I trust that my healthcare providers will tell me if a mistake is made about my medical treatment.**
- TRUST12A** Trust12 1
- 1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
8 = Refuse to Answer
- Q67. In the past 6 weeks or since [MOAGO1], I could not get to a clinic or doctor because I did not have transportation.**
- TRANSP1A** clinic 1
- 0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer
- Q68. In the past 6 weeks or since [MOAGO1], I did not have transportation to get to a food store or place where I get food or meals.**
- TRANSP2A** doctor 1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q69. In the past 6 weeks, I did not have a place to stay.

HOUSE1A home

1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q70. In the past 6 weeks, I worried about having a place to stay.

HOUSE2A place to stay

1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q71. In the past 6 weeks, I received food stamps or SNAP benefits.

FDSTAMP1 food stamps/SNAP

1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q72. In the past 6 weeks, I had to choose between paying for medicine or buying food.

FDSTAMP2 med or food

1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q73. In the past 6 weeks, I worried whether my food would run out before I got money to buy more.

FDSEC1A food run out

1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q74. In the past 6 weeks, the food that I bought just did not last and I did not have money to get more.

FDSEC2A Food security 2: no money for food

1

0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer

Q75. In the past 6 weeks, I could not afford to eat balanced meals.

FDSEC3A balanced meals

1

0 = No this is not true for me
1 = Yes this is true for me

8 = Refuse to Answer

- Q76. In the past 6 weeks, other adults in my household or myself cut the size of our meals or skipped meals because there was not enough money for food.**

FDSEC4A skip/cut meals

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

- Q77. In the past 6 weeks, I ate less than I felt I should because there was not enough money for food**

FDSEC5A Food security 5: eat less

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

- Q78. In the past 6 weeks, I was hungry, but did not eat, because I could not afford enough food.**

FDSEC6A Food security 6: afford enough food

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

- Q79. In the past 6 weeks, I lost weight because I did not have enough money for food.**

FDSEC7A Food security 7: lose wt.

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

- Q80. In the past 6 weeks, others in my household or I did not eat for a whole day because there was not enough money for food.**

FOOD1A eat for a whole day

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

- Q81. How do you usually get to the food store or other place where you get food?**

FOOD2A trans to food store

1

1 = Walk

2 = Drive Myself

3 = Someone drives me

4 = Bus

5 = MARTA Train

6 = Other

8 = Refuse to Answer

- Q82. How many times did you usually eat cold cereals?**

MULTI1A cereals

2

- 0 = Never
- 1 = 1-3 times last month
- 2 = 1-2 times per week
- 3 = 3-4 times per week
- 4 = 5 - 6 times per week
- 5 = 1 time per day
- 6 = 2 times per day
- 7 = 3 times per day
- 8 = 4 or more times per day
- 98 = Refuse to Answer

Q83. How many times did you drink milk or use milk on cereal?

MULTI2A Milk

2

- 0 = Never
- 1 = 1-3 times last month
- 2 = 1-2 times per week
- 3 = 3-4 times per week
- 4 = 5-6 times per week
- 5 = 1 time per day
- 6 = 2 times per day
- 7 = 3 times per day
- 8 = 4 or more times per day
- 98 = Refuse to Answer

Q84. What kind of milk did you usually drink in the past 6 weeks?

MULTI3A kind of milk

1

- 1 = Whole Milk
- 2 = 2% fat
- 3 = 1% fat
- 4 = Fat free
- 5 = Skim Milk
- 6 = I did not drink milk in the past month
- 8 = Refuse to Answer

Q85. In the past 6 weeks or since [MOAGO1], how many times did you usually eat bacon or sausage?

MULTI4A bacon or sausage

2

- 0 = Never
- 1 = 1-3 times last month
- 2 = 1-2 times per week
- 3 = 3-4 times per week
- 4 = 5-6 times per week
- 5 = 1 time per day
- 6 = 2 times per day
- 7 = 3 times per day
- 8 = 4 or more times per day
- 98 = Refuse to Answer

Q86. How often did you eat hot dogs?

MULTI5A hot dogs

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q87. How often did you eat whole grain bread, rolls, or sandwiches, such as whole wheat bread?

MULTI6A bread

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q88. How often did you drink 100% fruit juice such as orange, apple, and grape juice? - DO NOT COUNT FRUIT DRINKS, such as Kool-aide, lemonade, Hi-C?

MULTI7A Juice

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q89. In the past 6 weeks or since [MOAGO1], how often did you eat fresh, frozen, or canned fruit?

MULTI8A Fruit

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week

- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q90. How often did you use regular (not fat free) salad dressing, dressings, spreads, or mayonnaise on salads or sandwiches?

MULTI9A dressing

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q91. How often did you eat lettuce or green leafy salad?

MULTI10A salad

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q92. How often did you eat French fries, home fries, hash browns, or other fried potatoes?

MULTI11A french fries

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q93. How often did you eat baked potatoes, boiled potatoes, mashed potatoes or potato salad?

MULTI12A potatoes

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q94. In the past 6 weeks or since [MOAGO1], how often did you eat cooked dried beans, such as baked beans, refried beans, bean soup, or pork and beans?

MULTI13A beans

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q95. How often did you usually eat other raw, cooked, canned, or frozen vegetables?

MULTI14A vegetables

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q96. How many times did you usually eat any kind of pasta, like spaghetti, noodles, macaroni and cheese, pasta salads, or any other kind of pasta?

MULTI15A pasta

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week

- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q97. How often did you eat peanuts, walnuts, seeds, or other kinds of nuts?

MULTI16A Nuts

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q98. In the past 6 weeks or since [MOAG01], how often did you eat regular types of potato chips, tortilla chips, nachos chips, or corn chips?

MULTI17A chips

2

- 0** = Never
- 1** = 1-3 times last month
- 2** = 1-2 times per week
- 3** = 3-4 times per week
- 4** = 5-6 times per week
- 5** = 1 time per day
- 6** = 2 times per day
- 7** = 3 times per day
- 8** = 4 or more times per day
- 98** = Refuse to Answer

Q99. Having HIV makes me feel like I'm a bad person.

HIVINT1A bad person

1

- 1** = Strongly Agree
- 2** = Agree
- 3** = Uncertain
- 4** = Disagree
- 5** = Strongly Disagree
- 8** = Refuse to Answer

Q100. I feel I'm not as good as others because I have HIV.

HIVINT2A not as good as others

1

- 1** = Strongly Agree

- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q101. I feel ashamed of having HIV.

HIVINT3A HIV Stigma Internalized 3: ashamed

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q102. I think less of myself because I have HIV.

HIVINT4A HIV Stigma Internalized 4:less of self

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q103. Having HIV makes me feel unclean.

HIVINT5A HIV Stigma Internalized 5: unclean

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 8 = Refuse to Answer

Q104. Because of my HIV status, family members will avoid me.

HIVANT1A HIV Anticipated Stigma 1: avoid me

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely
- 4 = Likely
- 5 = Very likely
- 8 = Refuse to Answer

Q105. Because of my HIV status, family members will look down on me.

HIVANT2A HIV Anticipated Stigma 2: look down on me

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely

- 4 = Likely
- 5 = Very likely
- 8 = Refuse to Answer

Q106. Because of my HIV status, family members will treat me differently.

HIVANT3A HIV Anticipated Stigma 3: differently

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely
- 4 = Likely
- 5 = Very likely
- 8 = Refuse to Answer

Q107. Because of my HIV status, community/social workers will discriminate against me.

HIVANT5A HIV Anticipated Stigma 5: discriminate

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely
- 4 = Likely
- 5 = Very likely
- 8 = Refuse to Answer

Q108. Because of my HIV status, community/social workers will deny me services.

HIVANT6A HIV Anticipated Stigma 6: deny me

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely
- 4 = Likely
- 5 = Very likely
- 8 = Refuse to Answer

Q109. Because of my HIV status, healthcare workers will not listen to my concerns.

HIVANT7A HIV Anticipated Stigma 7: not listen

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely
- 4 = Likely
- 5 = Very likely
- 8 = Refuse to Answer

Q110. Because of my HIV status, healthcare workers will avoid touching me.

HIVANT8A HIV Anticipated Stigma 8: touching

1

- 1 = Very unlikely
- 2 = Unlikely
- 3 = Neither unlikely nor likely
- 4 = Likely
- 5 = Very likely

8 = Refuse to Answer

Q111. Because of my HIV status, healthcare workers will treat me with less respect.

HIVANT9A HIV Anticipated Stigma 9: less respect

1

1 = Very unlikely

2 = Unlikely

3 = Neither unlikely nor likely

4 = Likely

5 = Very likely

8 = Refuse to Answer

Q112. Because of my HIV status, family members have avoided me.

HIVENAC1 HIV Stigma Enacted 1: avoided

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

Q113. Because of my HIV status, family members have looked down on me.

HIVENAC2 HIV Stigma Enacted 2: looked down

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

Q114. Because of my HIV status, family members have treated me differently.

HIVENAC3 HIV Stigma Enacted 3: treated me differently

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

Q115. People have discriminated against me because of my HIV status.

HIVENAC5 HIV Stigma Enacted 5: discriminated 1

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

Q116. I have been denied services because of my HIV status.

HIVENAC6 HIV Stigma Enacted 6: avoided 1

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

Q117. Because of my HIV status, healthcare workers have not listened to my concerns.

HIVENAC7 HIV Stigma Enacted 7: not listen

1

0 = No this is not true for me

1 = Yes this is true for me

8 = Refuse to Answer

- Q118. People have avoided touching me because of my HIV status.**
HIVENAC8 HIV Stigma Enacted 8: touching 1
0 = No this is not true for me
1 = Yes this is true for me
8 = Refuse to Answer
- Q119. Are there people you have not told that you are HIV positive because you are afraid of their reaction?**
DISC1A DISC1 1
0 = No
1 = Yes
8 = Refuse to Answer
- Q120. Have you ever been denied health care services because of your HIV status?**
DISC2A DISC2 1
0 = No
1 = Yes
8 = Refuse to Answer
- Q121. Has a health care provider treated you poorly because you are HIV positive?**
DISC3A DISC3 1
0 = No
1 = Yes
8 = Refuse to Answer
- Q122. Are there health care providers, including dentist, nurse, or doctor, that you have not told you have HIV to avoid being discriminated against?**
DISC4A DISC4 1
0 = No
1 = Yes
8 = Refuse to Answer
- Q123. There are several people that I trust to help me solve problems.**
SS1A people that i trust 1
1 = Completely true
2 = Mostly true
3 = Mostly false
4 = Completely false
8 = Refuse to Answer
- Q124. There is no one that I feel comfortable talking to about intimate personal problems.**
SS2A no one that I feel comfortable talking to about personal problems 1
1 = Completely true
2 = Mostly true

- 3 = Mostly false
- 4 = Completely false
- 8 = Refuse to Answer

Q125. If I were sick and needed someone to take me to a doctor, I would have trouble finding someone.

SS4A getting to doctor

1

- 1 = Completely true
- 2 = Mostly true
- 3 = Mostly false
- 4 = Completely false
- 8 = Refuse to Answer

Q126. If I needed a place to stay for a week because of an emergency, I could easily find someone who would put me up.

SS5A emergency stay

1

- 1 = Completely true
- 2 = Mostly true
- 3 = Mostly false
- 4 = Completely false
- 8 = Refuse to Answer

Q127. I feel that there is no one I can share my most private worries and fears.

SS6A share worries

1

- 1 = Completely true
- 2 = Mostly true
- 3 = Mostly false
- 4 = Completely false
- 8 = Refuse to Answer

Q128. I feel a strong emotional bond with at least one other person.

SS8A emotional bond

1

- 1 = Completely true
- 2 = Mostly true
- 3 = Mostly false
- 4 = Completely false
- 8 = Refuse to Answer

Q129. There is someone I can turn to for advice about handling problems.

SS9A advice for problems

1

- 1 = Completely true
- 2 = Mostly true
- 3 = Mostly false
- 4 = Completely false
- 8 = Refuse to Answer

Q130. When I need suggestions on how to deal with a personal problem, I know

someone I can turn to.

SS10A someone to turn to

1

- 1** = Completely true
- 2** = Mostly true
- 3** = Mostly false
- 4** = Completely false
- 8** = Refuse to Answer

Q131. If I needed an emergency loan of \$100, there is someone I could get it from.

SS11A emergency loan

1

- 1** = Completely true
- 2** = Mostly true
- 3** = Mostly false
- 4** = Completely false
- 8** = Refuse to Answer

Q132. I have a close relationship that provides me with a sense of emotional security and well-being.

SS13A close relationship

1

- 1** = Completely true
- 2** = Mostly true
- 3** = Mostly false
- 4** = Completely false
- 8** = Refuse to Answer

Q133. In the past week, I was bothered by things that usually do not bother me.

CESD1A CESD (1): bother me

1

- 0** = 0 Days
- 1** = 1-2 Days
- 2** = 3-4 Days
- 3** = 5-7 Days
- 8** = Refuse to Answer

Q134. In the past week, I had trouble keeping my mind on what I was doing.

CESD2A CESD (2): trouble keeping my mind on task

1

- 0** = 0 Days
- 1** = 1-2 Days
- 2** = 3-4 Days
- 3** = 5-7 Days
- 8** = Refuse to Answer

Q135. In the past week, I felt depressed.

CESD3A CESD (3): Depressed

1

- 0** = 0 Days
- 1** = 1-2 Days
- 2** = 3-4 Days
- 3** = 5-7 Days

8 = Refuse to Answer

Q136. In the past week, I felt that everything that I did was an effort.

CESD4A CESD (4): effort

1

0 = 0 Days

1 = 1-2 Days

2 = 3-4 Days

3 = 5-7 Days

8 = Refuse to Answer

Q137. In the past week, I felt hopeful about the future.

CESD5A CESD (5): future

1

0 = 0 Days

1 = 1-2 Days

2 = 3-4 Days

3 = 5-7 Days

8 = Refuse to Answer

Q138. In the past week, I felt fearful.

CESD6A CESD (6): fearful

1

0 = 0 Days

1 = 1-2 Days

2 = 3-4 Days

3 = 5-7 Days

8 = Refuse to Answer

Q139. In the past week, my sleep was restless.

CESD7A CESD (7): restless sleep

1

0 = 0 Days

1 = 1-2 Days

2 = 3-4 Days

3 = 5-7 Days

8 = Refuse to Answer

Q140. In the past week, I was happy.

CESD8A CESD (8): happy

1

0 = 0 Days

1 = 1-2 Days

2 = 3-4 Days

3 = 5-7 Days

8 = Refuse to Answer

Q141. In the past week, I felt lonely.

CESD9A CESD (9): lonely

1

0 = 0 Days

1 = 1-2 Days

- 2 = 3-4 Days
- 3 = 5-7 Days
- 8 = Refuse to Answer

Q142. In the past week, I had crying spells.

CESD10A CESD (10): crying spells

1

- 0 = 0 Days
- 1 = 1-2 Days
- 2 = 3-4 Days
- 3 = 5-7 Days
- 8 = Refuse to Answer

Q143. In the past week, I felt sad.

CESD11A CESD (11): sad

1

- 0 = 0 Days
- 1 = 1-2 Days
- 2 = 3-4 Days
- 3 = 5-7 Days
- 8 = Refuse to Answer

Q144. In the past week, I could not get going.

CESD12A CESD (12): could not get going

1

- 0 = 0 Days
- 1 = 1-2 Days
- 2 = 3-4 Days
- 3 = 5-7 Days
- 8 = Refuse to Answer

Q145. People are more likely to miss taking their medications if they have been drinking alcohol.

ALCTOX1A miss meds

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q146. Alcohol and HIV medication should never be mixed.

ALCTOX2A not mix

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q147. Drinking alcohol can make HIV worse by harming the immune system.

ALCTOX3A harm immune system

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q148. Alcohol breaks down HIV medications so they will not work right.

ALCTOX4A meds wont work

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q149. A person should stop taking their HIV medications if they are going to be drinking.

ALCTOX5A stop meds

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q150. How often do you have a drink containing alcohol?

AUDIT1A alcohol question 1: how often

1

- 0 = Never
- 1 = Monthly or less
- 2 = 2 - 4 times per MONTH
- 3 = 2-3 times per WEEK
- 4 = 4 or more times per WEEK
- 8 = Refuse to Answer

Q151. How many drinks containing alcohol do you have on a typical day when you are

drinking?

AUDIT2A alcohol question 2: hom many drinks

1

- 0** = 1 or 2
- 1** = 3 or 4
- 2** = 5 or 6
- 3** = 7 to 9
- 4** = 10 or more
- 8** = Refuse to Answer

Q152. How often do you have 6 or more drinks on one occasion?

AUDIT3A alcohol question 3: > 6 drinks

1

- 0** = Never
- 1** = Less than monthly
- 2** = Monthly
- 3** = Weekly
- 4** = Daily or almost daily
- 8** = Refuse to Answer

Q153. How often during the last year have you found that you were not able to stop drinking once you had started?

AUDIT4A alcohol question 4: not able to stop

1

- 0** = Never
- 1** = Less than monthly
- 2** = Monthly
- 3** = Weekly
- 4** = Daily or almost daily
- 8** = Refuse to Answer

Q154. How often during the last year have you failed to do what was normally expected of you due to drinking?

AUDIT5A alcohol question 5: failed to to do expected

1

- 0** = Never
- 1** = Less than monthly
- 2** = Monthly
- 3** = Weekly
- 4** = Daily or almost daily
- 8** = Refuse to Answer

Q155. How often during the last year have you needed to have a drink first thing in the morning to get yourself going after a heavy drinking session?

AUDIT6A alcohol question 6: first drink in morning

1

- 0** = Never
- 1** = Less than monthly
- 2** = Monthly
- 3** = Weekly
- 4** = Daily or almost daily
- 8** = Refuse to Answer

Q156. How often during the last year have you had a feeling of guilt or remorse after drinking?

AUDIT7A alcohol question 7: remorse

1

- 0** = Never
- 1** = Less than monthly
- 2** = Monthly
- 3** = Weekly
- 4** = Daily or almost daily
- 8** = Refuse to Answer

Q157. How often during the last year have you been unable to remember what happened the night before because you had been drinking?

AUDIT8A alcohol question 8: can't remember

1

- 0** = Never
- 1** = Less than monthly
- 2** = Monthly
- 3** = Weekly
- 4** = Daily or almost daily
- 8** = Refuse to Answer

Q158. Have you or someone else been injured as a result of your drinking?

AUDIT9A Alcohol question 9: injured

1

- 0** = No
- 2** = Yes, but not past year
- 4** = Yes, in past year
- 8** = Refuse to Answer

Q159. Has a relative, friend, doctor or other health worker been concerned about your drinking or suggested you cut down?

AUDIT10A Alcohol 10: concern

1

- 0** = No
- 2** = Yes, but not past year
- 4** = Yes, in past year
- 8** = Refuse to Answer

Q160. How often have you used marijuana or pot in the past 6 weeks?

SUB1A substance use 1 (Q286): pot

1

- 0** = Never
- 1** = About one time a MONTH
- 2** = About one time a WEEK
- 3** = Several times a WEEK
- 4** = About every DAY
- 8** = Refuse to Answer

Q161. How often have you used powder or crack cocaine in the past 6 weeks?

SUB2A substance use 2 (Q287): cocain

1

- 0 = Never
- 1 = About one time a MONTH
- 2 = About one time a WEEK
- 3 = Several times a WEEK
- 4 = About every DAY
- 8 = Refuse to Answer

Q162. How often have you used any other drug without a prescription in the past 6 weeks?

SUB6A substance use 6 (Q292): other drugs

1

- 0 = Never
- 1 = About one time a MONTH
- 2 = About one time a WEEK
- 3 = Several times a WEEK
- 4 = About every DAY
- 8 = Refuse to Answer

Q163. I have little control over the things that happen to me.

MASTERY1 MASTERY1

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q164. There is really no way I can solve some of the problems I have.

MASTERY2 MASTERY2

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q165. There is little I can do to change many of the important things in life.

MASTERY3 MASTERY3

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q166. I often feel helpless in dealing with the problems of life.

MASTERY4 MASTERY4

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree

5 = Strongly Disagree

Q167. Sometimes I feel I'm being pushed around in life.

MASTERY5 MASTERY5

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q168. What happens to me in the future mostly depends on me.

MASTERY6 MASTERY6

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q169. I can do just about anything I really set my mind to do.

MASTERY7 MASTERY7

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q170. I feel that I am a person of worth, at least on an equal plane with others.

ESTEEM1A ESTEEM1

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q171. I feel that I have a number of good qualities.

ESTEEM2A ESTEEM2

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q172. All in all, I am inclined to feel that I am a failure.

ESTEEM3A ESTEEM3

1

- 1 = Strongly Agree
- 2 = Agree

- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q173. I am able to do things as well as most other people.

ESTEEM4A ESTEEM4

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q174. I feel I do not have much to be proud of.

ESTEEM5A ESTEEM5

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q175. I take a positive attitude toward myself.

ESTEEM6A ESTEEM6

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q176. On the whole, I am satisfied with myself.

ESTEEM7A ESTEEM7

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q177. I wish I could have more respect for myself.

ESTEEM8A ESTEEM8

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q178. I certainly feel useless at times.

ESTEEM9A ESTEEM9

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q179. At times, I think I am no good at all.
ESTEEM10 ESTEEM10 1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q180. In uncertain times, I usually expect the best.
PESS1A PESS1 1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q181. Its easy for me to relax.
PESS2A PESS2 1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q182. If something can go wrong for me, it will.
PESS3A PESS3 1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q183. Im always optimistic about my future.
PESS4A PESS4 1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q184. I enjoy my friends a lot.

	PESS5A	PESS5			1
				1 = Strongly Agree 2 = Agree 3 = Uncertain 4 = Disagree 5 = Strongly Disagree	
Q185.	Its important for me to keep busy.				
	PESS6A	PESS6			1
				1 = Strongly Agree 2 = Agree 3 = Uncertain 4 = Disagree 5 = Strongly Disagree	
Q186.	I hardly ever expect things to go my way.				
	PESS7A	PESS7			1
				1 = Strongly Agree 2 = Agree 3 = Uncertain 4 = Disagree 5 = Strongly Disagree	
Q187.	I dont get upset too easily.				
	PESS8A	PESS8			1
				1 = Strongly Agree 2 = Agree 3 = Uncertain 4 = Disagree 5 = Strongly Disagree	
Q188.	I rarely count on good things happening to me.				
	PESS9A	PESS9			1
				1 = Strongly Agree 2 = Agree 3 = Uncertain 4 = Disagree 5 = Strongly Disagree	
Q189.	Overall, I expect more good things to happen to me than bad.				
	PESS10A	PESS10			1
				1 = Strongly Agree 2 = Agree 3 = Uncertain 4 = Disagree 5 = Strongly Disagree	

Q190. In the past 6 weeks, or since [WKAGO6], how often have you felt excited?

EMOTION1 EMOTION1

1

- 1 = Never
- 2 = Sometimes
- 3 = Often
- 4 = Very Often
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q191. In the past 6 weeks, or since [WKAGO6], how often have you felt happy?

EMOTION2 EMOTION2

1

- 1 = Never
- 2 = Sometimes
- 3 = Often
- 4 = Very Often
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q192. In the past 6 weeks, or since [WKAGO6], how often have you felt sad?

EMOTION3 EMOTION3

1

- 1 = Never
- 2 = Sometimes
- 3 = Often
- 4 = Very Often
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q193. In the past 6 weeks, or since [WKAGO6], how often have you felt angry?

EMOTION4 EMOTION4

1

- 1 = Never
- 2 = Sometimes
- 3 = Often
- 4 = Very Often
- 7 = Don't Know
- 8 = Refuse to Answer
- 9 = Not Applicable

Q194. In the past 6 weeks, or since [WKAGO6], how often have you felt nervous?

EMOTION5 EMOTION5

1

- 1 = Never
- 2 = Sometimes
- 3 = Often
- 4 = Very Often
- 7 = Don't Know

8 = Refuse to Answer
9 = Not Applicable

Q195. In setting priorities, we must consider all groups.

SDO1A SDO1

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q196. We should not push for group equality.

SDO2A SDO2

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q197. Group equality should be our ideal.

SDO3A SDO3

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q198. Superior groups should dominate inferior groups

SDO4A SDO4

1

- 1 = Strongly Agree
- 2 = Agree
- 3 = Uncertain
- 4 = Disagree
- 5 = Strongly Disagree

Q199. Criticized you.

SOSTRS1A SOSTRS1

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q200. Ignored you.

SOSTRS2A SOSTRS2

1

- 0 = Not at all

- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q201. Left you out of a social activity.

SOSTRS3A SOSTRS3

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q202. Told negative things about you to another person.

SOSTRS4A SOSTRS4

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q203. Yelled at you.

SOSTRS5A SOSTRS5

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q204. Took something of yours without asking.

SOSTRS6A SOSTRS6

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q205. Acted bossy.

SOSTRS7A SOSTRS7

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q206. Lied to you.

SOSTRS8A SOSTRS8

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q207. Told confidential things about you to another person.

SOSTRS9A SOSTRS9

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q208. Didn't pay back borrowed money.

SOSTRS10 SOSTRS10

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q209. Friends spent less time with you.

SOSTRS11 SOSTRS11

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q210. Didn't call or come over when they said they would.

SOSTRS12 SOSTRS12

1

- 0 = Not at all
- 1 = Once or Twice
- 2 = About once a week
- 3 = Several times a week
- 4 = About every day

Q211. In the last 6 weeks, or since [MOAGO1], how often have you been upset because of something that happened unexpectedly?

PSS1A Upset by something happening unexpectedly

1

- 0 = Never
- 1 = Almost never
- 2 = Sometimes
- 3 = Fairly often
- 4 = Very often
- 8 = Refuse to Answer

Q212. In the last 6 weeks, or since [MOAGO1], how often have you felt that you were unable to control the important things in your life?

PSS2A Unable to control the important things

1

- 0** = Never
- 1** = Almost never
- 2** = Sometimes
- 3** = Fairly often
- 4** = Very often
- 8** = Refuse to Answer

Q213. In the last 6 weeks, or since [MOAGO1], how often have you felt nervous and "stressed"?

PSS3A Felt nervous and stressed

1

- 0** = Never
- 1** = Almost never
- 2** = Sometimes
- 3** = Fairly often
- 4** = Very often
- 8** = Refuse to Answer

Q214. In the last 6 weeks, or since [MOAGO1], how often have you felt confident about your ability to handle personal problems?

PSS4A Confident in ability to handle personal problems

1

- 0** = Never
- 1** = Almost never
- 2** = Sometimes
- 3** = Fairly often
- 4** = Very often
- 8** = Refuse to Answer

Q215. In the last 6 weeks, or since [MOAGO1], how often have you felt that things were going your way?

PSS5A Things going your way

1

- 0** = Never
- 1** = Almost never
- 2** = Sometimes
- 3** = Fairly often
- 4** = Very often
- 8** = Refuse to Answer

Q216. In the last 6 weeks, or since [MOAGO1], how often have you found that you could not cope with all the things that you had to do?

PSS6A Could not cope

1

- 0** = Never
- 1** = Almost never
- 2** = Sometimes

3 = Fairly often
4 = Very often
8 = Refuse to Answer

Q217. In the past 6 weeks, or since [MOAGO1], how often have you been able to control irritations in your life?

PSS7A Control irritations

1

0 = Never
1 = Almost never
2 = Sometimes
3 = Fairly often
4 = Very often
8 = Refuse to Answer

Q218. In the last 6 weeks, or since [MOAGO1], how often have you felt that you were on top of things?

PSS8A Felt on top of things

1

0 = Never
1 = Almost never
2 = Sometimes
3 = Fairly often
4 = Very often
8 = Refuse to Answer

Q219. In the last 6 weeks, or since [MOAGO1], how often have you been angered because of things that were outside of your control?

PSS9A Angered by things outside of control

1

0 = Never
1 = Almost never
2 = Sometimes
3 = Fairly often
4 = Very often
8 = Refuse to Answer

Q220. In the last 6 weeks, or since [MOAGO1], how often have you felt difficulties were piling up so high that you could not overcome them?

PSS10A Could not overcome difficulties

1

0 = Never
1 = Almost never
2 = Sometimes
3 = Fairly often
4 = Very often
8 = Refuse to Answer

Q221. In the past 6 weeks, or since [MOAGO1], did you start receiving disability?

STRSS1A disability

1

0 = No did not happen in the last month

1 = Yes happened in the past month
8 = Refuse to Answer

Q222. How stressful was going on disability?

STRS1A how stress disability

1

0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer

Q223. In the past 6 weeks, or since [MOAGO1], have you had a friend with a serious illness?

STRSS2A serious illness

1

0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer

Q224. How stressful was having a friend with a serious illness?

STRS2A how stress friend with serious illness

1

0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer

Q225. In the past 6 weeks, or since [MOAGO1], have you tried to meet new people?

STRSS3A meet new people

1

0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer

Q226. How stressful was trying to meet new people?

STRS3A how stress meeting new people

1

0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer

Q227. In the past 6 weeks, or since [MOAGO1], did you experience discrimination?

STRSS4A discrimination

1

0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer

Q228. How stressful was experiencing discrimination?

STRS4A how stress discrimination

1

0 = No Stress

1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer

- Q229. In the past 6 weeks, or since [MOAGO1], did you have a change in your viral load?**
STRSS5A change in vl 1
0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q230. How stressful was having a change in your viral load?**
STRS5A how stress change in vl 1
0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q231. In the past 6 weeks, or since [MOAGO1], did you have a change in your T Cells or CD4 count?**
STRSS6A change in tcells 1
0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q232. How stressful was having a change in your T Cells or CD 4 count?**
STRS6A how stress change in cd4 1
0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q233. In the past 6 weeks, or since [MOAGO1], did you start a new HIV medication?**
STRSS7A started new hiv med 1
0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q234. How stressful was starting a new HIV medication?**
STRS7A how stress starting new hiv med 1
0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q235. In the past 6 weeks, or since [MOAGO1], did you miss taking ANY of your HIV medications?**

- STRSS8A** missed meds 1
- 0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q236. How stressful was missing your HIV medication?**
- STRS8A** how stress miss meds 1
- 0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q237. In the past 6 weeks, or since [MOAGO1], have you had a serious illness?**
- STRSS9A** serious illness 1
- 0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q238. How stressful was having a serious illness?**
- STRS9A** how stress serious illness 1
- 0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q239. In the past 6 weeks, or since [MOAGO1], were you hospitalized overnight or longer?**
- STRSS10A** hospitalized 1
- 0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q240. How stressful was being hospitalized?**
- STRS10A** how stress hospitalized 1
- 0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q241. In the past 6 weeks, or since [MOAGO1], did you have a change in your health?**
- STRSS11A** change in health 1
- 0 = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q242. How stressful was having a change in your health?**

- STRS11A** how stress change in health 1
- 0** = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q243. In the past 6 weeks, or since [MOAGO1], did you change doctors?**
- STRSS12A** change doctor 1
- 0** = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q244. How stressful was changing doctors?**
- STRS12A** how stress changing doctor 1
- 0** = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q245. In the past 6 weeks, or since [MOAGO1], did you have a change in your appearance?**
- STRSS13A** change in appearance 1
- 0** = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q246. How stressful was having a change in your appearance?**
- STRS13A** how stress change in appearance 1
- 0** = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer
- Q247. In the past 6 weeks, or since [MOAGO1], did you disclose your HIV status to a family member?**
- STRSS14A** disclose to family 1
- 0** = No did not happen in the last month
1 = Yes happened in the past month
8 = Refuse to Answer
- Q248. How stressful was disclosing your HIV status to a family member?**
- STRS14A** how stress disclose to family 1
- 0** = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer

Q249. In the past 6 weeks, or since [MOAGO1], did you disclose your HIV status to a friend?

STRSS15A disclose to friend

1

0 = No did not happen in the last month

1 = Yes happened in the past month

8 = Refuse to Answer

Q250. How stressful was disclosing your HIV status to a friend?

STRS15A how stress disclose to a friend

1

0 = No Stress

1 = A Little Stress

2 = A Lot of Stress

8 = Refuse to Answer

Q251. In the past 6 weeks, or since [MOAGO1], did you disclose your HIV status to a sex partner?

STRSS16A disclose to sex partner

1

0 = No did not happen in the last month

1 = Yes happened in the past month

8 = Refuse to Answer

Q252. How stressful was disclosing your HIV status to a sex partner?

STRS16A how stress disclose to sex parnter

1

0 = No Stress

1 = A Little Stress

2 = A Lot of Stress

8 = Refuse to Answer

Q253. In the past 6 weeks, or since [MOAGO1], did you start a new relationship, such as an intimate relationship?

STRSS17A new relationship

1

0 = No did not happen in the last month

1 = Yes happened in the past month

8 = Refuse to Answer

Q254. How stressful was starting a new relationship?

STRS17A how stress start a new relationship

1

0 = No Stress

1 = A Little Stress

2 = A Lot of Stress

8 = Refuse to Answer

Q255. In the past 6 weeks, or since [MOAGO1], did an important relationship end?

STRSS18A end relationship

1

0 = No did not happen in the last month

1 = Yes happened in the past month
8 = Refuse to Answer

Q256. How stressful was ending a relationship?

STRS18A how stress ending relationship

1

0 = No Stress
1 = A Little Stress
2 = A Lot of Stress
8 = Refuse to Answer

Q257. I found the Wisepill device convenient to use.

WISEPIL1 easy to use

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree

Q258. I did not mind using the Wisepill device to hold my medications.

WISEPIL2 did not mind

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
7 = Don't Know
8 = Refuse to Answer
9 = Not Applicable

Q259. I did not like using the Wisepill device because I could not fit enough of my medications in the compartments.

WISEPIL3 not fit meds

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
7 = Don't Know
8 = Refuse to Answer
9 = Not Applicable

Q260. I was concerned that I would lose/damage the Wisepill device.

WISEPIL4 concerned

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree

5 = Strongly Disagree
7 = Don't Know
8 = Refuse to Answer
9 = Not Applicable

Q261. I believe having the Wisepill device helped me remember to take my medications.

WISEPIL5 helped remember

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
7 = Don't Know
8 = Refuse to Answer
9 = Not Applicable

Q262. I liked using the Wisepill device.

WISEPIL6 liked

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
7 = Don't Know
8 = Refuse to Answer
9 = Not Applicable

Q263. I felt uncomfortable using the Wisepill device because I feared someone might see and ask me questions.

WISEPIL7 uncomfortable

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
7 = Don't Know
8 = Refuse to Answer
9 = Not Applicable

Q264. I would be happy to participate in another study involving the Wisepill device.

WISEPIL8 happt to again

1

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree
7 = Don't Know

8 = Refuse to Answer
9 = Not Applicable

Q265. Enter password and then SAVE assessment

PASSA password

3

122 - 124 = range

Calculated Variable

TOTTIME Elapsed time

TOTTIME = Elapsed interview/data entry time

Appendix G: Financial Assessment

The following interview is going to ask about what financial/monetary resources you have received in the past 45 days during the daily study. We are interested in how this may be related to the other daily data that you have provided (i.e. transportation, food, alcohol use and medication adherence).

Creating anchors

“Thinking back over the last 45 days, did anything special happen? Holidays, birthdays, visitors or other special events.”

Using these anchors, the research staff member will help the participant fill out the calendar using the following questions as prompts:

1. Do you have a job? Do you get paid weekly, biweekly, monthly? What day(s) did you receive your paycheck(s)? What was the amount?
2. Did you collect disability? When did you get that check(s)? What was the amount?
3. Did you collect Social Security? When did you get that check(s)? What was the amount?
4. Did you collect unemployment? When did you get that check(s)? What was the amount?
5. Did you receive another other type of monetary assistance? What day(s) did that occur?

What was the amount? Please note what other types of

assistance_____

DECEMBER 2014

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10 Enrolled in Daily Study	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25 DS Pay 1	26	27
28	29	30	31			

January 2015

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8 DS Pay 2	9	10
11	12	13	14	15	16	17
18	19	20	21	22 DS Pay 3	23	24
25	26 DS Pay 4	27	28	29	30	31

Appendix H: Multilevel Modeling Formulas

Multilevel modeling is a form of generalized regression methods that allows for nested data structures. These nested data structures. In the current study, “level 1” units consist of the daily level data and they are nested within the “level 2” units or individuals. This modeling technique accounts for the shared variances that the daily level data has because these data points all come from the same individual (Gelman, 2006). The following equations are used to estimate these models:

$$\text{Level 1:} \quad Y_{ij} = \beta_{0j} + \beta_{1j}(X_{ij}) + e_{ij}$$

$$\text{Level 2:} \quad \beta_{0j} = \gamma_{00} + U_{0j}$$

$$\beta_{1j} = \gamma_{10} + U_{1j}$$

i = day

j = individual

X_{ij} = Level 1 predictor

β_{0j} = the intercept of the dependent variable in individual j

β_{1j} = the slope for the relationship in individual j between the Level 1 predictor and the dependent variable

e_{ij} = within participant errors

γ_{00} = grand intercept

γ_{10} = grand slope

U_{0j} = between participants differences (intercept)

U_{1j} = between participants differences (slope)

Appendix I: Annotated Code for Multilevel Models Run Using R

missing data

```
library(mice)
```

```
imp<-mice(Daily, m = 5)
```

```
complete(imp)
```

##Test Habituation – Missed Doses

```
library(lme4)
```

```
m1<- with(imp, glmer(MissedDose~Day + (Day|PID), family=binomial(link=logit), data =  
Daily))
```

```
summary(m1)
```

##Test Habituation – Food Insecurity

```
m2<- with(imp, glmer(FoodAny~Day + (Day|PID), family=binomial(link=logit), data = Daily))
```

```
summary(m2)
```

```
## model failed to converge as logit- converted to probit
```

```
m2<- with(imp, glmer(FoodAny~Day + (Day|PID), family=binomial(link=probit), data = Daily))
```

```
summary(m2)
```

```
#hunger
```

```
m2a<- with(imp, glmer(Q5~ Day + (Day|PID), family=binomial(link=logit), data = Daily))
```

```
summary(m2a)
```

```
#Ate less
```

```
m2b<- with(imp, glmer(Q4~ Day + (Day|PID), family=binomial(link=logit), data = Daily))
```

```
summary(m2b)
```

```
#worry
```

```
m2c<- with(imp, glmer(Q3~ Day + (Day|PID), family=binomial(link=logit), data = Daily))
```

```
summary(m2c)
```

```
#got food from pantry
```

```
m2d<- with(imp, glmer(Q6~ Day + (Day|PID), family=binomial(link=logit), data = Daily))
```

```
summary(m2d)
```

Testing the daily relationship between food insecurity and missed doses of medication without control variables

```
m3imp <- with(imp, glmer(MissedDose ~ FoodAny + Day + (FoodAny + Day + FoodAny*Day|  
PID), family=binomial(link=logit), data = Daily))
```

```
summary(m3imp)
```

```
# failed to converge but max|grad| very small small =.005
```



```
## adding in control variables income and education
m4imp <- with(imp, glmer(MissedDose ~ FoodAny + Day + ZIncom45 + ZEduc + (FoodAny +
Day + FoodAny*Day| PID), family=binomial(link=logit), data = Daily))
summary(m4imp)
# failed to converge but max|grad| very small =.001
```

##testing individual items of food insecurity with Missed Doses

```
#worry
m5imp <- with(imp, glmer(MissedDose ~ Q3 + Day + (Q3 + Day + Q3*Day| PID),
family=binomial(link=logit), data = Daily))
summary(m5imp)
# failed to converge but max|grad| small =.04; day variance very low 0.0003
m5imp <- with(imp, glmer(MissedDose ~ Q3 + Day + Q3*Day + (Day| PID),
family=binomial(link=logit), data = Daily))
summary(m5imp)
```

```
#ate less than needed to
m6imp <- with(imp, glmer(MissedDose ~ Q4 + Day + (Q4 + Day + Q4*Day| PID),
family=binomial(link=logit), data = Daily))
summary(m6imp)
# failed to converge but max|grad| very small =.00309574
```

```
#hungry but couldn't afford more food
m7imp <- with(imp, glmer(MissedDose ~ Q5 + Day + (Q5 + Day + Q5*Day| PID),
family=binomial(link=logit), data = Daily))
summary(m7imp)
# failed to converge but max|grad| very small= 0.00614193
```

```
#Adding in control variables to hunger
m8imp <- with(imp, glmer(MissedDose ~ Q5 + Day + ZIncom45 + ZEduc + (Q5 + Day +
Q5*Day| PID), family=binomial(link=logit), data = Daily))
summary(m8imp)
```

#Testing Alcohol Moderators

```
#Drinking yes or no daily predicting missed doses
m9imp <- with(imp, glmer(MissedDose ~ DrinkYN + Day + (Day + DrinkYN+ DrinkYN*Day|
PID), family =binomial(link=logit), data = DailyImp))
summary(m9imp)
```

```
Daily$Day_Q5 <-Daily$Day*Daily$Q5
Daily$Day_DrinkYN <- Daily$Day*Daily$DrinkYN
```

```
Daily$DrinkYN_Q5 <- Daily$DrinkYN * Daily$Q5
```

#drink yes no as a moderator

```
m10imp <- with(imp, glmer(MissedDose ~ DrinkYN + Q5 + Day + Daily$DrinkYN_Q5 +  
ZIncom45 + ZEduc + (Q5 + DrinkYN + Day + Daily$Day_Q5 + Daily$DrinkYN_Q5| PID),  
family = binomial(link=logit), data = Daily))
```

```
summary(m10imp)
```

```
warnings()
```

```
#model failed to converge in 10,000 evaluations; bobyqa - max number of function evaluations  
exceeded; max|grad| = 0.102441; day*q5 and day*drinkyn moved to fixed effects; AIC 1819.5
```

```
m10imp <- with(imp, glmer(MissedDose ~ DrinkYN + Q5 + Day + Daily$DrinkYN_Q5 +  
ZIncom45 + ZEduc + Daily$Day_Q5 + Daily$Day_DrinkYN + (Q5 + DrinkYN + Day +  
Daily$DrinkYN_Q5| PID), family = binomial(link=logit), data = Daily))
```

```
summary(m10imp)
```

```
warnings()
```

```
#model failed to converge in 10,000 evaluations; bobyqa - max number of function evaluations  
exceeded; max|grad| = 3.43168; AIC 1814.0 better fitting model than before
```

```
#only small variance is for day; tried probit model
```

```
m10imp <- with(imp, glmer(MissedDose ~ DrinkYN + Q5 + Day + Daily$DrinkYN_Q5 +  
ZIncom45 + ZEduc + Daily$Day_Q5 + Daily$Day_DrinkYN + (Q5 + DrinkYN + Day +  
Daily$DrinkYN_Q5| PID), family = binomial(link=probit), data = Daily))
```

```
summary(m10imp)
```

```
warnings()
```

```
#model failed to converge in 10,000 evaluations; max|grad| = 0.376384; AIC 1815 worse fitting  
model;
```

```
#went back to logit model; moved Q5 and DrinkYN out of random effects per Tania's suggestion  
Day*Q5 and Day*DrinkYN in fixed effects
```

```
m10imp <- with(imp, glmer(MissedDose ~ DrinkYN + Q5 + Day + Daily$DrinkYN_Q5 +  
ZIncom45 + ZEduc + Daily$Day_Q5 + Daily$Day_DrinkYN + (Day + Daily$DrinkYN_Q5|  
PID), family = binomial(link=logit), data = Daily))
```

```
summary(m10imp)
```

```
#model still failed to converge but only warning is max|grad| = 0.012269 is very low; also AIC  
1805.8 indicating better fit than all other models
```

```
Daily$Day_Q5 <- Daily$Day * Daily$Q5
```

```
Daily$Day_NumDrink <- Daily$Day * Daily$NumDrinkWSR
```

```
Daily$NumDrink_Q5 <- Daily$NumDrinkWSR * Daily$Q5
```

#Alcohol; number of drinks as a moderator;

```
m11imp <- with(imp, glmer(MissedDose ~ NumDrinkWSR + Q5 + Day + Daily$NumDrink_Q5  
+ ZIncom45 + ZEduc + (Q5 + NumDrinkWSR + Day + Daily$Day_Q5 +  
Daily$Day_NumDrink + Daily$NumDrink_Q5| PID), family = binomial(link=logit), data =  
Daily))
```

```
summary(m11imp)
```

```
warnings()
```

```

# In vcov.merMod(object, use.hessian = use.hessian) :variance-covariance matrix computed
from finite-difference Hessian is not positive definite; changed use.hessian to null
m11imp <- with(imp, glmer(MissedDose ~ NumDrinkWSR + Q5 + Day + Daily$NumDrink_Q5
+ ZIncom45 + ZEduc + (Q5 + NumDrinkWSR + Day + Daily$Day_Q5 +
Daily$Day_NumDrink + Daily$NumDrink_Q5| PID), family =binomial(link=logit), data =
Daily))
summary(m11imp, use.hessian = NULL)
##model failed to converge in 10,000 evaluations; bobyqa - max number of function evaluations
exceeded; max|grad| = 12.648
#moved Q5 and NumDrinks out of random effects per Tania's suggestion Day*Q5 and
Day*NumDrink in fixed effects
m11imp <- glmer(MissedDose ~ NumDrinkWSR + Q5 + Day + Daily$NumDrink_Q5 +
Daily$Day_Q5 + Daily$Day_NumDrink + ZIncom45 + ZEduc + (Q5 + NumDrinkWSR + Day
+ Daily$NumDrink_Q5| PID), family =binomial(link=logit), data = Daily)
summary(m11imp, use.hessian = NULL)
warnings()
#failure to converge in 10000 evaluations; max|grad| = 2.86562;
m11imp <- glmer(MissedDose ~ NumDrinkWSR + Q5 + Day + Daily$NumDrink_Q5 +
Daily$Day_Q5 + Daily$Day_NumDrink + ZIncom45 + ZEduc + (Q5 + NumDrinkWSR + Day
+ Daily$NumDrink_Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily)
summary(m11imp)
#model still failed to converge but far less warnings and max|grad| = 0.0886195; suggests
rescaling variables but all scaleable variables have already been scaled
#redo with imputed data
m11imp <- with(imp, glmer(MissedDose ~ NumDrinkWSR + Q5 + Day + Daily$NumDrink_Q5
+ Daily$Day_Q5 + Daily$Day_NumDrink + ZIncom45 + ZEduc + (Q5 + NumDrinkWSR +
Day + Daily$NumDrink_Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m11imp)
#still failed to converge but small max|grad| = 0.0886195; variances high
m11impa <- with(imp, glmer(MissedDose ~ NumDrinkWSR + Q5 + Day +
Daily$NumDrink_Q5 + Daily$Day_Q5 + Daily$Day_NumDrink + ZIncom45 + ZEduc + (Day
+ Daily$NumDrink_Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m11impa)
#variances look much better and max|grad| = 0.0317442

Daily$Day_Q5 <-Daily$Day*Daily$Q5
Daily$Day_BAC <- Daily$Day*Daily$ZBACSQRT
Daily$BAC_Q5 <-Daily$ZBACSQRT*Daily$Q5

```

Alcohol; eBAC as a moderator

```

m12imp <- with(imp, glmer(MissedDose ~ ZBACSQRT + Q5 + Day + Daily$BAC_Q5+
Daily$Day_BAC + Daily$Day_Q5 + ZIncom45 + ZEduc + (Q5 + ZBACSQRT + Day +

```

```

Daily$BAC_Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m12imp)
#model failed to converge; max|grad| = 0.553316; only low variance is for day; tried probit
model
m12imp <- with(imp, glmer(MissedDose ~ ZBACSQRT + Q5 + Day + Daily$BAC_Q5+
Daily$Day_BAC + Daily$Day_Q5 + ZIncom45 + ZEduc + (Q5 + ZBACSQRT + Day +
Daily$BAC_Q5| PID), family =binomial(link=probit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m12imp)
#failed to converge but max|grad| = 0.00877666
#degenerate hessian
summary(m12imp, use.hessian = NULL)

```

#Geospatial moderators

#City Center

```

m20imp <- with(imp,glmer(MissedDose ~ Day + Q5 + ZCityLG + ZCityLG*Q5 + ZIncom45 +
ZEduc + (Q5 + Day + Day*Q5| PID), family =binomial(link=logit), data = Daily))
summary(m20imp)
#failed to converge in 10000 evaluations
m20imp <- with(imp, glmer(MissedDose ~ Day + Q5 + ZCityLG + ZCityLG*Q5 + ZIncom45 +
ZEduc + (Q5 + Day + Day*Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m20imp)
# model failed to converge max|grad| = 0.382983; moved Q5 to fixed as Day*Q5; AIC 1639.1
m20imp <-with(imp, glmer(MissedDose ~ Day + Q5 + ZCityLG + ZCityLG*Q5 + ZIncom45 +
ZEduc + Day*Q5+ (Q5 + Day + Day*Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m20imp)
#model failed to converge max|grad| = 4.2239; AIC 1642.1; model worse than previous
m20imp <- imp, glmer(MissedDose ~ Day + Q5 + ZCityLG + ZCityLG*Q5 + ZIncom45 +
ZEduc + (Q5 + Day + Day*Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m20imp)

```

#Nearest supermarket

```

m21imp <-with(imp, glmer(MissedDose ~ Day + Q5 + ZSuperSR + ZSuperSR*Q5 +
ZIncom45 + ZEduc + (Q5 + Day + Day*Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m21imp)
#model failed to converge max|grad| = 0.0104897; AIC 1635.5; moved Q5 to fixed as Day*Q5
m21imp <- with(imp, glmer(MissedDose ~ Day + Q5 + ZSuperSR + ZSuperSR*Q5 +
ZIncom45 + ZEduc + Day*Q5 + (Day| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))

```

```
summary(m21imp)
#model converged; AIC 1627; better than previous
```

#Nearest public transportation stop

```
m22imp <- with(imp, glmer(MissedDose ~ Day + Q5 + ZTransLG + ZTransLG*Q5 +
ZIncom45 + ZEduc + (Q5 + Day + Day*Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m22imp)
# max|grad| = 0.0147011; AIC 1634.1; moved Q5 to fixed as Day*Q5
m22imp <- with(imp, glmer(MissedDose ~ Day + Q5 + ZTransLG + ZTransLG*Q5 +
ZIncom45 + ZEduc + Day*Q5 + (Day | PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m22imp)
#max|grad| = 0.0040269; AIC 1625.9 better fit
#nearest public transportation stop controlling for trouble getting where needed to go
m22impa <- with(imp, glmer(MissedDose ~ Day + Q5 + Q2 + ZTransLG + ZTransLG*Q5 +
ZIncom45 + ZEduc + Day*Q5 + Day*Q2 + (Day | PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m22impa)
```

#Participant pharmacy

```
m23imp <-with(imp, glmer(MissedDose ~ Day + Q5 + ZPharmSR + ZPharmSR*Q5 +
ZIncom45 + ZEduc + (Q5 + Day + Day*Q5| PID), family =binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(m23imp)
#max|grad| = 0.00944797; AIC 1464.5
```

##Reserve Capacity Models

#Stressful events as mediator

```
library(mediation)
```

```
#mediation of stressful experiences
```

```
med.fit1 <- with(imp, lmer(ZStressorsFU ~ Day + Q5 + ZStressors + ZIncom45 + ZEduc +
(Day + Q5 + Day*Q5| PID), na.action = "na.omit", data = Daily))
summary(med.fit1)
#model failed to converge max|grad| = 26.7439; moved Q5 to fixed as Day*Q5
med.fit1 <- with(imp, lmer(ZStressorsFU ~ Day + Q5 + ZStressors + ZIncom45 + ZEduc +
Day*Q5 + (Day| PID), na.action = "na.omit", data = Daily))
summary(med.fit1)
#model failed to converge max|grad| = 33.654; increased number of evaluations
med.fit1a <- with(imp, lmer(ZStressorsFU ~ Day + Q5 + ZStressors + ZIncom45 + ZEduc +
Day*Q5 + (Day| PID), control=lmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(med.fit1a)
#still failed to converge; added addition control variables
```

```

med.fit1 <- with(imp, lmer(ZStressorsFU ~ Day + Q5 + ZStressors + ZIncom45 + ZEduc +
Day*Q5 + Age + Gender + (Day| PID), control=lmerControl(optCtrl=list(maxfun=100000)),
data = Daily))
summary(med.fit1)
# downdated VtV is not positive definite
med.fit1 <- with(imp, lmer(ZStressorsFU ~ Day + Q5 + ZStressors + ZIncom45 + ZEduc +
Day*Q5 + Age + Gender + (Day + Q5 + Day*Q5| PID),
control=lmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(med.fit1)
#model still failed to converge max|grad| = 28.2407; original model seems best
med.fit1b <- with(imp, lmer(ZStressorsFU ~ Day + Q5 + ZStressors + ZIncom45 + ZEduc +
(Day + Q5 + Day*Q5| PID), na.action = "na.omit", data = Daily))
summary(med.fit1b)

out.fit1a <- with(imp, glmer(MissedDose ~ ZStressorsFU + Day + Q5 + ZStressors +
ZIncom45 + ZEduc + (Day + Q5 + Day*Q5| PID), family = binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(out.fit1a)
#failed to converge but max|grad| = 0.0100559

med.out1 <- mediate(med.fit1, out.fit1, treat = "Daily$Q5", mediator = "Daily$ZStressorsFU")
summary(med.out1)

library(mediation)

#Reserve Capacity
med.fit2 <- with(imp, lmer(ZResCapFU ~ Day + Q5 + ZResCap + ZIncom45 + ZEduc + (Day
+ Q5 + Day*Q5| PID), na.action = "na.omit", data = Daily))
summary(med.fit2)
#max|grad| = 14.4762
med.fit2a <- with(imp, lmer(ZResCapFU ~ Day + Q5 + ZResCap + ZIncom45 + ZEduc +
Day*Q5 + (Day| PID), na.action = "na.omit", data = Daily))
summary(med.fit2a)
# model fit worse; back to original
med.fit2 <- with(imp, lmer(ZResCapFU ~ Day + Q5 + ZResCap + ZIncom45 + ZEduc + (Day
+ Q5 + Day*Q5| PID), na.action = "na.omit", data = Daily))
summary(med.fit2)

out.fit2 <- with(imp, glmer(MissedDose ~ ZResCapFU + Day + Q5 + ZResCap + ZIncom45 +
ZEduc + (Day + Q5 + Day*Q5| PID), family = binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(out.fit2)
#failed to converge max|grad| = 0.144222

```

```

out.fit2 <- with(imp, glmer(MissedDose ~ ZResCapFU + Day + Q5 + ZResCap + ZIncom45 +
ZEduc + Day*Q5 + (Day| PID), family = binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(out.fit2)

```

```

med.out2 <-mediate(med.fit2, out.fit2, treat ="Q5", mediator ="ZResCapFU",
robustSE=FALSE, sims=500)
summary(med.out2)

```

#emotion

```

med.fit3 <- with(imp, lmer(ZEmotionFU ~ Day + Q5 + ZEmotion + ZIncom45 + ZEduc +
(Day + Q5 + Day*Q5| PID), na.action = "na.omit", data = Daily))
summary(med.fit3)

```

#model failed to converge max|grad| = 16.3113;

```

med.fit3a <- with(imp, lmer(ZEmotionFU ~ Day + Q5 + ZEmotion + ZIncom45 + ZEduc +
Day*Q5 + (Day| PID), na.action = "na.omit", data = Daily))
summary(med.fit3a)

```

#Downdated VtV is not positive definite; went back to original model

```

med.fit3 <- with(imp, lmer(ZEmotionFU ~ Day + Q5 + ZEmotion + ZIncom45 + ZEduc +
(Day + Q5 + Day*Q5| PID), na.action = "na.omit", data = Daily))
summary(med.fit3)

```

```

out.fit3 <- with(imp, glmer(MissedDose ~ ZEmotionFU + Day + Q5 + ZEmotion + ZIncom45
+ ZEduc + Day*Q5 + (Day + Q5 + Day*Q5| PID), family = binomial(link=logit),
control=glmerControl(optCtrl=list(maxfun=100000)), data = Daily))
summary(out.fit3)

```

#failed to converge but max|grad| = 0.0239524;

```

med.out3 <-mediate(med.fit3, out.fit3, treat ="Q5", mediator ="ZEmotionFU",
robustSE=FALSE, sims=500)
summary(med.out3)

```