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Mackenzie Hurlston   April 18th, 2012

Exploring Food Insecurity in HIV-Positive Inpatients

at Grady Memorial Hospital in Atlanta, GA

By

Mackenzie Ann Hurlston

Master of Science in Public Health

Global Health and Public Nutrition

_____

Nicholas Vogenthaler, MD MPH

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Exploring Food Insecurity in HIV-Positive Inpatients

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Mackenzie Ann Hurlston

B.A. Emory University, 2008

Thesis Committee Chair: Nicholas Vogenthaler, MD MPH

An abstract of

A thesis submitted to the Faculty of the
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2012

Abstract

Exploring Food Insecurity in HIV-Positive Inpatients
at Grady Memorial Hospital in Atlanta, GA

by Mackenzie Ann Hurlston

Background
Limited research has shown food insecurity or the "limited or uncertain availability of
nutritionally adequate and safe foods" to be a barrier to optimal HIV related health
outcomes.

Objective
To describe the prevalence and correlates of food insecurity in HIV-positive inpatients at
Grady Memorial Hospital in Atlanta, GA. as well as to explore the competing demands
between food insecurity, drug use, and access to treatment and care.

Methods
Structured interviews were administered at the bedside to participants recruited from
inpatient medicine wards for a one time cross-sectional survey. The Household Food
Insecurity Access Scale (HFIAS) questionnaire was used to assess food insecurity.

Results
Among 63 participants, 71.4% were food insecure and 44.4% were severely food insecure. In
bivariate analysis food insecurity was significantly associated with ever and current
homelessness, lack of health insurance, and monthly income less than $600. In adjusted
analysis, food insecurity was marginally significantly associated with ever homeless (AOR
3.37, CI=0.86-13.2). Monthly income greater than $600 neared a protective effect against
food insecurity (AOR 0.32, CI=0.08-1.23). Twenty percent of food insecure patients
reported missing a healthcare appointment in the past 90 days because they needed to spend
money on food and 18% reported the reverse: skipping a meal to pay to get to medical
appointment.

Conclusions
The prevalence of food insecurity seen in HIV-positive inpatients at Grady Memorial
Hospital is the largest reported prevalence among people living with HIV/AIDS in the
United States, a majority whom reported experiencing severe food insecurity. Competing
demands seen between food and medical treatment among the food insecure participants
suggests that food insecurity is directly affecting access to medical care. Finally limited food
stamp data suggest a significant underutilization of national food services in this population.
More research, specifically longitudinal studies, are necessary given the high prevalence of
food insecurity in this population in order to fully understand how food insecurity affects
treatment and care of HIV positive individuals at Grady Memorial Hospital.

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1   Introduction

The year 2011 marked thirty years since the discovery of HIV/AIDS. HIV, human

immunodeficiency virus, causes a disease that attacks the body's immune system. Without

treatment, the virus progressively compromises a person's immune system, leading to

chronic infections and eventually acquired immune deficiency syndrome (AIDS). The

severely compromised immune system of an AIDS patient results in increased morbidity and

premature mortality[1]. However, substantial progress has been made in HIV prevention and

care, including improved testing and counseling, improved education, and development of

HIV-specific drug treatment (antiretroviral therapy). When taken as directed, antiretroviral

therapy (ART) significantly decreases morbidity, reduces the transmission of HIV, and

prolongs the lives of people living with HIV/AIDS (PLWHA) [2].

Despite these successes, the U.S. Centers for Disease Control and Prevention (CDC)

estimates approximately 1.2 million people are living with HIV in the United States with

50,000 new infections occurring each year. Of those infected with HIV only an estimated

51% remain in care, resulting in many untreated HIV infections [1]. Untreated HIV

infections not only increase the risk of morbidity and mortality for the infected person, but

also increase the risk of transmission to other individuals. In 2010, President Barack Obama

outlined a National Strategy for HIV/AIDS focusing on three main goals: 1) to reduce the

number of new infections each year, 2) increase access to care and improve HIV health

outcomes, and 3) reduce HIV- related health disparities [3].

In both developed and developing countries food insecurity has been identified as a

structural barrier to optimal HIV health outcomes. Food insecurity, or the 'limited or

uncertain availability of nutritionally adequate and safe foods or the limited ability to acquire

nutritionally adequate and safe foods in socially acceptable ways" disproportionately affects PLWHA [4]. Current literature shows that food insecurity prevalence is significantly higher among HIV-positive populations than the general population [5], [6]. Limited research in the United States and Canada have begun to characterize the experience of food insecurity among PLWHA and have documented several associations with food insecurity including low income, homelessness, lack of health insurance, unemployment, and drug use. These associations have been seen in the general U.S. population; however since HIV is most concentrated in areas afflicted by poverty, the covariates associated with food insecurity are highly prevalent among PLWHA [7]. As a result, HIV-positive individuals are at greater risk for experiencing food insecurity. In the setting of chronic illness and poverty, increased food insecurity creates additional barriers to important needs including access to medical care because individuals are forced to prioritize more immediate subsistence needs.

Problem Statement

Beyond determining prevalence and covariates of food insecurity, it is necessary to investigate how food insecurity may be negatively impacting HIV treatment and care. One-quarter to one-third of individuals diagnosed with HIV will not return for medical care until they are in need of acute HIV-related treatment [8]. Limited evidence exists suggesting that food insecurity may be a factor in the low retention in care of HIV-positive patients [9]. In a study of food insecure HIV-positive individuals in Uganda, obtaining care was shown to be dependent upon both severity of illness and means to pay for medical treatment. Among the food insecure, medical treatment may not appear as immediately necessary as pursuit of other subsistence needs. However without consistent medical care, individuals do not benefit from treatment for HIV or additional services available through clinic programming,

and likely only seek care when acute treatment is needed. Reducing food insecurity may help improve healthcare utilization and even reduce healthcare expenses[9]. Therefore food insecurity interventions have the potential to not only improve food insecurity but also quality of life, retention to HIV services, HIV-specific health outcomes, and healthcare costs.

Special efforts have been made to reach PLWHA who are not currently in care in order to better understand how food insecurity acts as a barrier to care. Such studies have interviewed injection drug users, homeless individuals, and marginally housed individuals [6], [10], [11]. An underexplored population is the hospitalized inpatient population. The hospital provides a unique opportunity to engage with patients who are typically not in care and engage them with currently available services including food insecurity interventions.

Purpose Statement

The goal of this research project is to determine the prevalence and correlates of food insecurity in the HIV-positive inpatient population of Grady Memorial Hospital in Atlanta, GA. This research also seeks to examine the competing demands associated with food insecurity which may affect healthcare utilization.

Research Objectives

1. To describe the prevalence and correlates of food insecurity among HIV-infected inpatients at Grady Memorial Hospital in Atlanta, GA.
2. To explore the competing demands of food security, substance use, and access to treatment and care.

Significance Statement

Antiretroviral therapy has had a significant impact on reducing the number of new infections, prolonging lives, and improving the quality of life for PLWHA[12]. Food insecurity is an understudied barrier to optimal HIV-related health outcomes. Interventions to improve the food security status of impoverished, urban HIV-infected individuals may be necessary to achieve optimal HIV-related health outcomes. This thesis will gain information on the experience of food insecurity in a 'hard to reach' population of individuals who are often not receiving routine HIV care. The results will aid in the development of food security interventions designed to complement existing programs and improve linkage and retention to HIV care in the hospitalized setting.

2   Literature Review

2.1   Introduction to Literature Review

There are several objectives of this literature review. The first is to define food insecurity and describe how it is measured. The second objective is to give an overview of the documented prevalence of food insecurity among PLWHA in a developed setting. Third, the literature review will describe the sociodemographic and behavioral correlates of food insecurity documented in HIV-positive populations in the United States and Canada. Finally, the last section will describe the association of food insecurity with suboptimal clinical outcomes in HIV-positive individuals.

2.2   Measuring Food Insecurity

Measuring food insecurity is meant to capture the experiences regarding poor access to food independent of the potential effects of malnutrition. Food insecurity is experienced on a continuum from anxiety about having enough food, to eating the same foods repetitively, to skipping meals frequently due to food shortages. Hunger and food insecurity measures are designed to capture all aspects of this continuum and classify the spectrum of food insecurity into measurable categories [13].

Designed in 1990, the Radimer/Cornell Measures of Hunger and Food Insecurity was the first questionnaire to measure this experience and splits food insecurity into different categories at the household, individual, and child level [14]. There are twelve questions which cover varying food insecurity experiences including worrying about food, running out of food, not being able to eat healthy foods, and not being able to provide enough food for themselves or their children. Radimer suggests acceptable answers of "never true, sometimes

true, or often true." Sometimes and often true should be categorized as positive responses of food insecurity and factored into further analysis. Validation studies have shown this questionnaire can be used as suggested by Radimer to group household, individual, and child food insecurity levels, but it is also valid to categorize food insecurity by severity levels (e.g. food secure, food insecure, food insecure with hunger) because the questionnaire contains both dietary and non-dietary questions [15].

In the early 1990s, the U.S adapted Radimer/Cornell's questionnaire for use as a national survey of food insecurity. The U.S. Department of Agriculture (USDA) and a group of experts decided on an eighteen-question survey called The Household Food Security Survey (HFSS) [4]. Data from the U.S. Census Bureau's 1995 Current Population Survey was used for validation. For prevalence estimates, the USDA recommends that household/individuals be classified as mildly food insecure if three answers of the eighteen are positive, moderately food insecure if eight to twelve answers are positive, severely food insecure if greater than twelve are positive [4].

The final measure of food insecurity mentioned in this review, and used in this thesis, is the Household Food Insecurity Access Scale (HFIAS) Questionnaire (appendix I) adapted from the HFSS mentioned above by USAID's Food and Nutrition Technical Assistance project (FANTA) [13]. Validated in eight countries, including the United States, this questionnaire contains nine questions covering the three domains of food insecurity: worry and uncertainty about access to food, insufficient quality and variety of food, and the inability to obtain sufficient quantities of food. The questionnaire was designed to calculate different levels of food insecurity in a variety of populations in a simple yet rigorous way. Instead of counting the number of positive answers, FANTA suggests that relevant answers

are "never, rarely, sometimes, or often" and should be correlated with points 0, 1, 2, and 3 respectively. Then formulas (appendix II) using specific patterns of responses are correlated with food security categories, and households or individuals are classified as food secure, mildly food insecure, moderately food insecure, or severely food insecure [13].

2.3 Establishing Food Insecurity Prevalence in PLWHA

With the introduction of the HFSS in the U.S. in the early 1990s, food insecurity began to be routinely monitored and reported in the United States. Early general population surveys reported a food insecurity prevalence of 9.7%, or 10 million food insecure American households between 1996-1998 [16]. Research in the general population demonstrated associations between food insecurity and poor health outcomes in both children and adults including: depression and anxiety, poor cognitive development in children, as well as increased odds of obesity, diabetes, and other metabolic disorders [17] [18] [19] [20]. Several correlates of food insecurity including low socioeconomic status, homelessness, and illicit drug use are concentrated among PLWHA [19][20]. Concerns that PLWHA were disproportionately experiencing food insecurity and the potential health implications for an already chronically ill population spurred additional research.

In 2005, the first study of food insecurity in an HIV-positive population in a developed setting was published [21]. The cross sectional analysis found a food insecurity prevalence of 48%, five times higher than the general Canadian population. The study surveyed 1213 individuals (1116 men and 97 women) already enrolled in the British Columbia Drug Treatment Program and used patients' physicians to distribute the self-administered questionnaires. The questionnaire contained questions on sociodemographics, lifestyle choices, and health status as well as ten questions from the Radimer/Cornell

measures of hunger and food insecurity. Participants were classified as food insecure with one positive answer out of ten. These methods and results set the foundation for future food insecurity research in HIV-positive populations.

Since 2009 several articles have been published documenting the prevalence of food insecurity in varied HIV-positive populations. In a developed setting, HIV is predominantly concentrated among those with lower socioeconomic status as is food insecurity [22] [20]. Much of the research is now focused on marginalized populations who are often not engaged in care such as those with unstable housing, currently homeless individuals, and substance users. A study among homeless and marginally housed HIV-positive individuals in San Francisco has shown a food insecurity prevalence of approximately 51%[5]. A study of HIV-positive crack-cocaine users in Atlanta and Miami, reported a prevalence of 34% food insecurity[10].

Two recent Canadian studies published in 2011, using separate samples recruited from the same area, found a food insecurity prevalence of 71% in their HIV-positive participants [11][6]. Both studies recruited from Vancouver, British Columbia's Downtown Eastside. The prevalence seen here is almost identical to that reported in the 2005 study also recruited from this region in British Columbia [21]. The reported prevalence in the 2011 study was after food services had reportedly been increased among marginalized populations in British Columbia including HIV-positive individuals [6]. Studies of food insecurity among PLWHA in a developed setting have all documented a higher prevalence of food insecurity when compared to the general population.

Table 1. Summary of studies examined in prevalence estimates section of the literature review

Study	Location	Study Design	Participants	% FI
Anema et al, 2011	Vancouver, British Columbia, Canada	Cross-sectional	Previously enrolled in Longitudinal Investigations into Supportive and Ancillary Health Services (LISA) cohort • On HAART	71
Normen et al, 2005	Vancouver, British Columbia, Canada	Cross-sectional	Previously enrolled in British Columbia drug treatment program	48
Shannon et al, 2011	Vancouver, British Columbia, Canada	Prospective cohort with baseline and bi-annual follow-up	Enrolled in AIDS Care Cohort to Evaluate Exposure Science (ACCESS)	71
Vogenthaler et al, 2010	Atlanta, GA and Miami, Florida	Cross-sectional	Crack-cocaine users recruited from inpatient wards	34
Weiser et al, 2009	San Francisco, CA	Cross-sectional	Enrolled in cohort of homeless and marginally housed	54

2.4 Sociodemographic and Behavioral Correlates of Food Insecurity in PLWHA

Determining the correlates of food insecurity in this population is a necessary step in understanding how food insecurity is experienced by PLWHA and how best to structure food insecurity interventions.

Income is a strong predictor of food insecurity among PLWHA. A study in British Columbia documented that HIV-positive individuals with an annual income of less than $10,000 (Canadian dollars) had almost four times greater odds of being food insecure than other participants [AOR 3.78 (95% CI, 2.53 – 5.65)] [21]. A study conducted in the same region several years later reported annual income less than $Can 15,000 to be the strongest predictor of food insecurity [AOR 3.15 (95% CI 1.83, 5.44)] among HAART naïve participants in British Columbia in 2011 [6]. Income greater than $600/month had a protective effect on food insecurity status [AOR 0.19 (95% CI 0.06, 0.58)] among crack-

cocaine users in Atlanta and Miami [10]. In another study conducted in Atlanta, 80% of the population surveyed had a monthly income less than $1000 and 51% of the participants were classified as food insecure [23].

Other factors closely tied to income have also been shown to be associated with food insecurity including unemployment and unstable housing. In Atlanta, food insecurity has been shown to be associated with unemployment [AOR 1.9 (95% CI 1.1, 3.3)] and worry about having a place to live [AOR 6.3 (95% CI 3.9, 10.1)] [23]. Studies in British Columbia reported an association between unstable housing and food insecurity as well. In 2005, unstable housing was associated with two-fold greater odds of food insecurity [AOR 2.24 (95%CI, 1.15-4.34)] while being currently unemployed was associated with three times greater odds of food insecurity [AOR 3.15, 95% CI, 1.94 – 5.12)] [21]. In a study conducted in a similar population, stable housing had a protective effect against food insecurity in unadjusted analysis [AOR 0.26 (95%CI, 0.15-0.45)] [6]. Among crack-cocaine users in Atlanta and Miami, food insecurity was associated with living alone and being currently homeless. Current homelessness was the strongest independent predictor of food insecurity in this study with almost four times the odds of food insecurity [AOR 3.78 (95% CI 1.70, 8.41)] [10].

The correlates of food insecurity discussed above are concentrated among vulnerable populations. In a cohort of HIV-positive marginally housed and homeless individuals in San Francisco a lack of health insurance, recent incarceration, and crack use in the past 30 days were associated with food insecurity[5]. Lack of health insurance increased an individual's odds of being food insecure by 4.4 times [AOR 4.38 (95%CI, 1.21- 19.75)] and crack use in the last thirty days doubled odds of food insecurity [AOR 2.06 (95% CI 1.09, 3.71)]. Among

a largely homeless population of crack-cocaine users, possessing health insurance was associated with 2.4 greater odds of food insecurity [10]. In this study participants were more likely to have health insurance if they reported higher monthly income and were not homeless. Additionally, virtually all those with insurance reported having Medicaid.

Associations seen between drug use and food insecurity in PLWHA led to studies focused on HIV-positive drug users. A study among crack-cocaine users in Atlanta and Miami reported a significant association between crack-cocaine use and food insecurity: as crack-cocaine use decreased in frequency, percent food insecure also decreased [10]. A study among drug users in British Columbia reported associations in unadjusted analysis between homelessness, frequent crack smoking, frequent heroin injection, and frequent cocaine injection and food insecurity [11].

A single study among drug users in British Columbia, reported a correlation between food insecurity and unprotected sex among HIV-positive individuals [11]. This is the first study to report an association between food insecurity and high-risk sexual behavior in a resource-rich setting. Severe food insecurity was associated with 2.7 times increased odds of having unprotected sex [AOR 2.68 (95% CI 1.49, 4.82)]. International research has shown food insecurity to be associated with exchanging food for money or bargaining for basic needs [24]. Further research examining the links between food insecurity and unprotected sex in resource-rich settings is needed to draw further conclusions. If confirmed, addressing food insecurity could also decrease risky sexual behavior, particularly among women.

HIV medication adherence is important for both prevention of transmission and HIV progression [25]. Currently there is mixed evidence regarding the relationship between HIV medication non-adherence and food insecurity. Food insecurity and HIV medication

adherence was evaluated among individuals living in and just outside of urban Atlanta [26].

Overall, 42.5% of inner city participants were non-adherent, and 50.7% of participants living

outside the city were non-adherent. Non-adherence was classified as taking ART < 85% of

the time prescribed. 68% of non-adherent individuals living just outside of urban Atlanta

reported experiencing hunger in the previous 30 days [χ^2 13.2 (p-value < 0.01)]. However

food insecurity was not different among adherent and non-adherent groups living inside

Atlanta. In a large multi-site study including veterans across the United States, food

insecurity was linearly associated with non-adherence [27]. In a separate study conducted in

Atlanta, food insecurity and alcohol use were the only two significant independent predictors

of non-adherence at the 90% adherence cutoff [AOR 0.3 (95% CI 0.1, 0.9)] and 80% HIV

medication adherence cutoff [AOR 0.3 (95% CI 0.1, 0.8)] [23].

Table 2. Summary of studies examined in sociodemographic and behavioral correlates section

Study	Location	Study Design	Participants	Sociodemographic and Behavioral Correlates
Anema et al, 2011	Vancouver, British Columbia, Canada	Cross-sectional	Previously enrolled in Longitudinal Investigations into Supportive and Ancillary Health Services (LISA) cohort • On HAART	• Annual Income < $Can 15,000 • Tobacco smoking • Substance use • Depressive symptoms
Kalichman et al, 2010	Atlanta, GA	Cross-sectional	Recruited throughout Atlanta through numerous venues for phone interview On HAART	• Worried about having a place to live • Unemployed
Kalichman et al, 2011	Atlanta, GA	Cross-sectional	Recruited throughout Atlanta through numerous venues for phone interview • On HAART	• 42.5% of inner city participants were non-adherent • 50.7% living outside the city were non-adherent • 68% non-adherent participants living outside city are food insecure
Normen et al, 2005	Vancouver, British Columbia	Cross-sectional	Previously enrolled in BC drug treatment program	• Yearly Income < Can$10,000 • Unemployed • Living with Children
Shannon et al, 2011	Vancouver, British	Prospective Cohort with	Enrolled in AIDS Care Cohort to Evaluate	Unadjusted analysis: • Homeless

	Columbia	baseline and bi-annual follow-up	Exposure Science (ACCESS)	• Crack smoking • Inner-city residency • Heroin injection • Cocaine injection Adjusted analysis: • Severe Food insecurity associated with unprotected sex
Vogenthaler et al, 2010	Atlanta and Miami	Cross-sectional	Crack-cocaine users recruited from inpatient wards	• Living alone • Current homelessness • Crack use intensity • Religious service attendance • Possession of health insurance Protective: • Monthly income
Wang et al, 2011	Eight Veteran's Affairs Medical Centers across U.S.	Prospective Cohort	Veterans on HAART	• Linear association between food insecurity and HIV medication adherence
Weiser et al, 2009	San Francisco	Cross-sectional	Enrolled in REACH cohort of homeless and marginally housed	• Recent incarceration • Lack of health insurance • White vs. non-white

2.5 Clinical Outcomes Associated with Food insecurity in PLWHA

Although evidence is limited, incomplete viral suppression appears to be independently associated with food insecurity. A large multistate study determined that even after controlling for other factors associated with lack of virologic suppression, including ART adherence, food insecurity was associated with 1.3 greater odds of incomplete viral suppression [AOR 1.32 (95% CI 1.05, 1.68)] [27]. A study among homeless and marginally housed HIV-positive individuals in San Francisco also documented the association between incomplete viral suppression and food insecurity and noted it could not be fully explained by ART adherence[28]. Both authors suggest that intermittent severe periods of food insecurity could be playing a role in the absorption and mechanism of actions for the HIV medications.

CD4+ T-cell counts are an important measure of HIV disease stage, with lower CD4+ T-cell counts indicating more severe clinical stage. In a study conducted in San Francisco, food insecurity was associated with increased odds of having a CD4+ T-cell count less than two hundred [AOR 2.08 (95% CI 1.09, 3.94)] [5]. A longitudinal study showed a negative correlation between food insecurity and CD4+ T-cell counts [29]. This was the first study to evaluate the association between food insecurity and CD4+ T-cell counts longitudinally [29]. This prospective study included 592 participants with a minimum of four follow-up visits. Food insecurity was measured at each visit using the adult food security questions from Radimer/Cornell. Multivariate analysis demonstrated that food insecurity predicts an approximately 100 CD4+ T-cell decrease compared to a food secure individual [-99.52 cells, p <0.001], but each year of HAART increases CD4+ T-cell count by 40 cells regardless of food insecurity [40.36 cell increase over period observed, p <0.001]. Thus, according to this model after five years, a food secure person on HAART could expect a CD4+ t-cell increase of 194 cells, and a food insecure individual on HAART would only expect a 94-cell increase.

Table 3. Summary of studies examined in clinical outcomes section of literature review

Study	Location	Study Design	Participants	Clinical Outcomes
Weiser et al, 2009	San Francisco	Cross-sectional	Enrolled in cohort of homeless and marginally housed	• FI associated with CD4 <200
Weiser et al, 2009	San Francisco	Cross-sectional	Enrolled in cohort of homeless and marginally housed • On HAART	• Severely FI 79% lower odds of viral suppression • <80% adherent severely FI individuals -85% lower odds of viral suppression •
Wang et al, 2011	Eight Veteran's Affairs Medical Centers across U.S.	Prospective Cohort	Veterans on HAART	• 1.3 increased odds incomplete viral suppression when food insecure • ART adherence not fully responsible •
McMahon	Boston,	Prospective	Nutrition for Healthy	• Each year of HAART

| et al, 2011 | MA & Providence, RI | Cohort | Living (NFHL) participants
• Attended four or more study visits | increases CD4 T-cell count by 40 cells regardless of FI
• FI predicts an approximately 100 CD4 T-cell decrease from a food secure individual |

More research is needed to strengthen the evidence documenting the associations between food insecurity and poor clinical outcomes such as incomplete viral suppression, decreased CD4+ T-cell counts and CD4+ T-cell count recovery.

2.6 Conclusions

The current literature indicates that the prevalence of food insecurity is much higher in HIV-positive individuals than the general population. There is strong evidence of food insecurity's association with homelessness, low income, unemployment, lack of health insurance, and drug use. Other areas require additional research, specifically the relationship between food insecurity and medication adherence, unprotected sex, and HIV-specific clinical outcomes. Lastly, given local differences in HIV epidemics and services available, locally specific information on food insecurity will remain necessary to best tailor food insecurity interventions to those in need [30].

3   Methodology

3.1   Objectives

The overall objective of this thesis is to investigate the experience of food insecurity

in the HIV-positive inpatient population at Grady Memorial Hospital in downtown Atlanta.

The first objective is to determine the prevalence and correlates of food insecurity in this

population. Second, this thesis examines the competing demands between subsistence needs

and food insecurity in this population, and if food insecurity is also a competing demand that

affects HIV care and treatment.

3.2   Participants and Setting

The research took place at Grady Memorial Hospital (GMH), an inner-city public

hospital in Atlanta, Georgia. Grady serves residents of DeKalb and Fulton county which

combined house an estimated 22,500 PLWHA (prevalence of 1.4%) accounting for 48% of

PLWHA in the state of Georgia [31]. Previous food insecurity research conducted at GMH

and Jackson Memorial Hospital, an inner city Miami hospital, reported a food insecurity

prevalence of 34% among HIV-positive inpatients with a history of crack cocaine use.

Demographically HIV-positive inpatients at GMH are approximately 74% black, 18% white,

5% Hispanic, and 3% other or unstated. Women compose about 28% of this population.

Participants were recruited from inpatient medicine wards throughout July and

August of 2011 for a one-time cross-sectional survey. A convenience sample was taken from

the daily list of HIV-positive inpatients maintained by the GMH HIV social service staff.

Due to the large number of HIV-positive inpatients, scheduled medical procedures, and

illness severity, it was not possible to interview all HIV-positive inpatients during the study

period. Particular efforts were made to interview as many women as possible in order to

balance the sample. In order to participate, patients had to be 18 years of age or older, able to speak English, self-identify as HIV-positive, and be willing and interested in participating.

3.3   Ethics

The Emory Institutional Review Board (IRB) reviewed and approved the study protocol under the expedited review process under 45 CFR.46.110 because it posed minimal risks to study participants. The Grady Memorial Hospital Research Oversight Committee also granted study approval. Prior to administering the survey, interviewers obtained written informed consent. Interviews were approximately 30 minutes in length and participants were given $10 as compensation. All measures were taken to assure patient confidentiality. Each participant was assigned a unique study identification number (RID). This number was the only identifier attached to the questionnaire. The document that contained patient names and RIDs was kept locked securely in a cabinet located in an Emory research office. Although many patient rooms were single, in double and triple occupancy rooms patients were given the opportunity to complete the questionnaire in another more private location.

3.4   Data Collection

Structured interviews were administered at the bedside to eligible patients and all responses were recorded using Handheld-Assisted Personal Interview (HAPI). The questionnaire consisted of multiple sections: demographics, insurance status, employment and income, housing status, food insecurity (previous 30 days and previous year), competing demands, social support, substance use factors, sexual risk behavior, health care utilization, self-reported medical conditions, and antiretroviral (ARV) adherence (when applicable).

3.5   Food Insecurity Assessment

Food Insecurity was measured using the Household Food Insecurity Access Scale (HFIAS) questionnaire assessing food insecurity over both the past 30 days and the previous year. HFIAS contains nine questions covering three domains of food insecurity: worry and uncertainty about access to food, insufficient quality and variety of food, and the inability to obtain sufficient quantities of food. Available responses were never, rarely (once or twice), sometimes (three to ten times), and often (greater than ten times) in the previous thirty days which were coded 0, 1, 2, and 3 respectively. Responses were summed for each participant to create an HFIAS score, which ranges from 0 to 27. Higher scores reflect increased severity of food insecurity. Participants responses are further categorized so each participant falls into one unique category: food secure, mildly food insecure, moderately food insecure, or severely food insecure. Responses were categorized according to the HFIAS Indicator Guide recommendations [13]. The dependent variable assessed in the multivariate analysis is a dichotomous variable: food insecure meaning any level of food insecurity (mild, moderate, and severe) versus food secure, both in the previous 30 days.

The food insecurity experiences covered in the individual HFIAS questions were also examined. The frequencies of relevant responses (never, rarely, sometimes, and often) were graphically represented using Microsoft Excel 2010. This figure visualizes the general patterns of responses and to identifies experiences that are common for the entire population surveyed.

Covariates

Covariates for analysis were chosen based on known association with food insecurity shown in previous literature and are presented in Table 4 [5] [10] [21] [23]. The covariates chosen were: age (continuous), gender (male/female), race (black/non-black), monthly

income (<\$600/ >\$600), marital status (single/never been married versus other), health insurance (any/none), education (≥ versus <high school diploma), current employment (yes/no), ever homelessness (yes/no), current homelessness (yes/no), close friend (yes/no), substance use previous ninety days (yes/no), and daily alcohol (yes/no). Homelessness was defined as not having any place to stay including friend's house or apartment. Close friend was defined as "someone you could tell anything."

Competing Demands

To investigate the competing demands between food insecurity, drug use, medication adherence, and health care access a set of questions was utilized to explore which compromises (if any) individuals make in the presence of food insecurity. All individuals were asked questions regarding competing demands of both time and money (Table 7). Questions focused on three potential competing demands associated with food insecurity: 1) missed medical appointments due to time or money spent obtaining food, 2) skipped meals due to costs associated with getting to and/or paying for a medical appointment, and 3) skipped meals because of spending money or trading food for drugs. Participants on ARVs were asked additional questions about competing demands between food insecurity and ARV adherence. These questions asked if participants had not filled their ARV prescriptions, taken them late or off schedule, or skipped a dose due to time spent trying to obtain food. Two final questions asked about competing demands on money: 1) not purchasing ARV prescriptions because participant could not afford both food and medications and 2) skipping a meal or going hungry as a result of purchasing ARV medication.

3.6   Analysis

Food insecurity was compared with covariates in both a bivariate and multivariate analysis. In bivariate analysis, χ^2 and fisher's exact tests were used to evaluate associations with food insecurity in categorical variables and pooled t-tests were used for continuous variables (Table 5). Fisher's exact test was used when an expected cell count was less than five. Categorical data are presented as frequencies n (%) and continuous variables are presented as mean (SD). Covariates with a p-value less than 0.25 in bivariate analysis were entered into the multivariate model. Age, gender, and race were forced into the final model. Current homelessness, while strongly associated with food insecurity in the bivariate analysis, was not included in the multivariate model. All currently homeless participants were food insecure, making it a perfect predictor of food insecurity in this sample and a non-informative variable in the model. Statistical significance was defined as a p-value of ≤ 0.05 and p-values <0.10 were considered marginally significant. All statistical analysis was carried out using SAS software (SAS Institute, Cary, North Carolina, Version 9).

4   Results

4.1   Participant Characteristics

Through July and August of 2011, 63 HIV-positive inpatients at Grady Memorial Hospital completed the cross-sectional survey. A majority of participants, 71.4%, were characterized as food insecure. Of the food insecure, 9.5% were mildly food insecure, 17.5% moderately food insecure, and 44.4% severely food insecure (Figure 1).
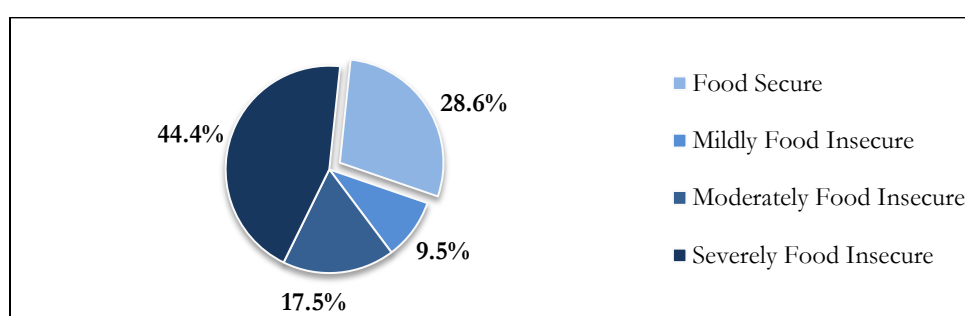
Figure 1. Food Insecurity Status of HIV+ Inpatients – GMH

Selected participant characteristics are presented in Table 4. The mean age of participants was 44 years old, with a range of 23 to 70 years. A majority of participants were single (69.8%), black non-Hispanic (82.5%), and male (84.1%). Just over half of the participants had no insurance including Medicare and Medicaid. Seventy-five percent reported having a high school diploma or equivalent. Seventy-nine percent of participants were currently unemployed and 60.3% had a monthly income of less than $600. Twenty percent of the sample was currently homeless and approximately half (50.8%) reported experiencing homelessness previously. A majority of participants (76.2%) had a close friend they could trust to tell anything. Eight percent of participants drank alcohol daily and less than a quarter of participants (20.6%) had used any illegal drugs or substances in the past ninety days.

Table 4. Selected Characteristics of the Study Population

Characteristic	n	%
Gender		
Female	10	15.9
Male	53	84.1
Race/Ethnicity		
Black, non-Hispanic	52	82.5
Other	11	17.5
Monthly income		
< $600	38	60.3
≥ $600	25	39.7
Marital status		
Single, never married	44	69.8
Other	19	30.2
Health insurance		
Any insurance	28	44.4
None identified	35	55.6
Education		
< High school diploma	16	25.4
≥ High school diploma	47	74.6
Employment		
Unemployed	50	79.4
Employed	13	20.6
Ever homelessness		
Yes	32	50.8
No	31	49.2
Current homelessness		
Yes	13	20.6
No	50	79.4
Close Friend		
Yes	48	76.2
No	15	23.8
Substance use, past 90 days		
Yes	13	20.6
No	50	79.4
Daily alcohol		
Yes	5	7.9
No	58	92.1

	Mean	SD
Age		
Mean, SD	44.4	10.1

4.2   Characterization of Food Insecurity

Responses to the nine HFIAS questions are illustrated in Figure 2. Fifty-two percent of participants reported eating a limited variety of foods and eating foods that they did not prefer due to low resources. Forty percent of participants reported eating fewer meals in a day due to lack of food, and 45% reported eating smaller meals than they felt they needed. A similar proportion of individuals, 40%, reported worrying about their food supply. Less participants, one-quarter, reported not having any food at home, going to sleep hungry, and not eating for an entire day due to an inability to access food. Forty-four percent of the population reported experiencing at least one severe indicator in the previous 30 days. Among those who reported experiencing severe food insecurity, 40% reported experiencing a single severe indicator, 28% experienced two, and 32% experienced all three indicators in the past thirty days.

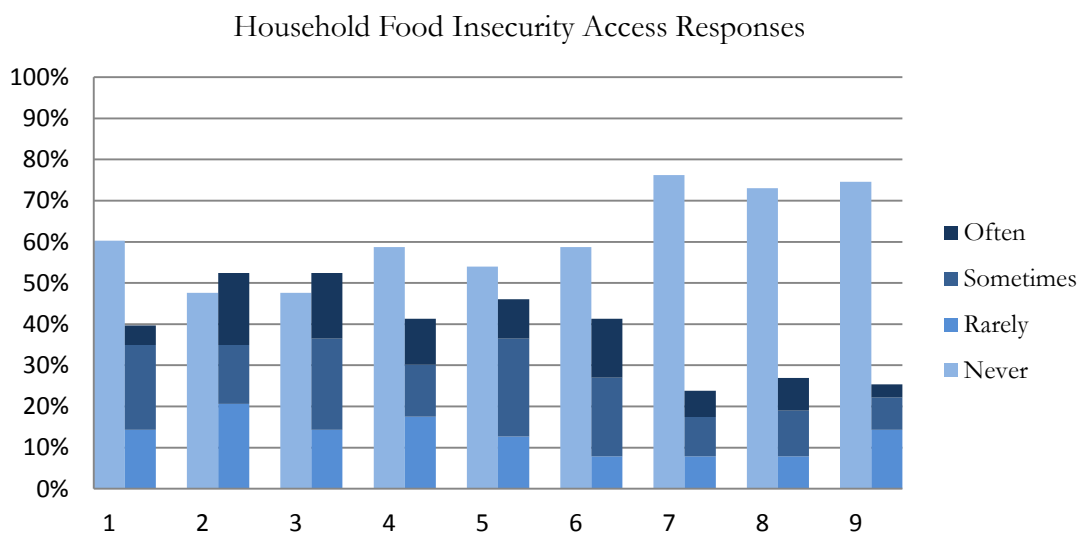**Figure 2.** Response Profile - Household Food Insecurity Access Questions about past 30 days

1. Did you worry that you would not have enough food?

2. Were you not able to eat the kinds of foods you preferred because of a
    lack of resources?

3. Did you eat just a few kinds of food day after day due to a lack of
   resources?

4. Did you eat food that you preferred not to eat because a lack of resources
   to obtain other types of food?

5. Did you eat a smaller meal than you felt you needed because there was not
   enough food?

6. Did you eat fewer meals in a day because there was not enough food?

7. Was there ever no food at all where you stay because you did not have
   resources to get more?

8. Did you go to sleep at night hungry because there was not enough food?

9. Did you go a whole day without eating anything because there was not
   enough food?

4.3   Correlates of Food Insecurity

In bivariate analysis, food insecurity was significantly associated with monthly income, ever homelessness, and current homelessness (Table 5). Health insurance was marginally statistically associated with food insecurity. In multivariate analysis no predictors reached the statistical significance level of 0.05; however, ever homelessness and a monthly income >$600 trended towards significance (Table 6). Ever homelessness was the strongest predictor of food insecurity in this model (AOR 3.37, CI = 0.68 - 13.2) and a monthly income greater than $600 neared a protective effect against food insecurity (AOR 0.32, CI= 0.08 – 1.23). Health insurance was not a significant predictor in the multivariate model.

Table 5. Bivariate association between food insecurity (FI) and selected socio-demographic factors

Characteristic	% FI	p-value
Gender		0.71
Female	80.0	
Male	69.8	
Race/Ethnicity		1.00
Black, non-Hispanic	71.2	
Other	72.3	
Monthly income		<0.01
< $600	84.2	
≥ $600	52.0	
Marital status		0.34
Single, never married	75.0	
Other	63.2	
Health insurance		0.09
Any insurance	82.1	
None identified	62.9	
Education		0.76
< High school diploma	68.8	
≥ High school diploma	72.3	
Employment		0.49
Unemployed	74.0	
Employed	61.5	
Ever homelessness		0.02
Yes	84.4	
No	58.1	
Current homelessness		0.01
Yes	100.0	
No	64.0	
Close Friend		0.52
Yes	68.8	
No	80.0	
Substance use, past 90 days		0.32
Yes	84.6	
No	68.0	
Daily alcohol		0.62
Yes	60.0	
No	72.4	
	Mean (SD)	**p-value**
Age		0.18
Mean (SD)	45.5 (10.0)	

Table 6. Multivariate logistic regression model of factors associated with food insecurity

Characteristic	AOR (95% CI)
Age (per year)	1.03 (0.97-1.11)
Gender (Female vs. Male)	1.24 (0.16-9.74)
Race (Black vs. Other)	0.98 (0.18-5.36)
Ever Homelessness (Yes vs. No)	3.37 (0.86-13.20)*
Monthly income	
< $600 vs. ≥ $600	0.32 (0.08-1.23)*
Health insurance (Yes vs. No)	3.08 (0.77-13.45)

*p-value < 0.10

4.4   Competing Demands

All food secure individuals (n=18) responded "never" to the six questions regarding competing demands between food insecurity, drugs, and health care access in the past 90 days (Table 7). Food insecure individuals reported experiencing each situation covered in this section. Twenty percent of food insecure individuals reported they had missed medical appointments due to spending money on food rather than spending money getting to or paying for their appointment. Eighteen percent of food insecure participants reported skipping a meal to spend money to get to a medical appointment. Sixteen percent reported skipping a meal in the past ninety days because they had to pay for a medical appointment. Thirteen percent of food insecure participants spent money on drugs and did not have enough money left for food. Less than 10% of food insecure participants reported missing an appointment with a healthcare provider because they were spending time trying to get food or trading food for drugs, alcohol, or cigarettes.

Table 7. Competing demands experienced with food insecurity

	Food Secure (n = 18) n (%)	Food Insecure (n = 45) n (%)
Competing Time		
Did you <u>miss an appointment</u> with a healthcare provider because you were spending time trying to get food?	0 (0)	4 (8.9)
Competing Money		
Did you <u>miss an appointment</u> with a healthcare provider because you needed to spend money on food rather than spending money either getting to or paying for your appointment?	0 (0)	9 (20.0)
Did you <u>skip a meal</u> or go hungry because you needed to spend money to get to a medical appointment (for instance, bus, train or taxi fare)?	0 (0)	8 (17.8)
Did you <u>skip a meal</u> or go hungry because you needed to spend money on a medical co-payment, or because you had to <u>pay for a medical</u> appointment?	0 (0)	7 (15.6)
Did you <u>skip a meal</u> or go hungry because you spent money on drugs and alcohol and had not enough money left for food?	0 (0)	6 (13.3)
Did you <u>trade food</u> for drugs, alcohol or cigarettes?	0 (0)	2 (4.4)

Twenty-nine participants were currently on ART and answered the additional competing demands questions. Table 8 shows all questions related to competing demands among participants on ART only. The nine food secure participants on ART reported "never" experiencing ten of the eleven competing demands situations. Two food secure (22%) and five food insecure participants (25%) reported not filling ARV prescriptions from the pharmacy because they could not afford both food and their medications. Five food insecure participants reported the reverse situation: skipping a meal because they spent money purchasing their prescriptions. Five food insecure participants reported missing a medical appointment because they spent money on food rather than getting to or paying for their medical appointment. Five food insecure participants on ART also reported skipping a meal because they needed to spend money paying for a medical appointment. For each

situation mentioned above, the same five participants did not report experiencing all four situations. One person reported experiencing all four, four participants reported experiencing three of the four, one participant experienced two, and two participants reported one each.

Table 8: Competing demands with food insecurity among participants on ART

	Food Secure (n = 9) n (%)	Food Insecure (n = 20) n (%)
Competing Time		
Did you miss an appointment with a healthcare provider because you were spending time trying to get food?	0 (0)	1 (5.0)
Did you not fill your antiretroviral (ARV) prescriptions from the pharmacy because you were spending time trying to get food?	0 (0)	0 (0)
Did you take your ARV medication late or off schedule because you were spending time trying to get food??	0 (0)	3 (15.0)
Did you miss a dose of your ARV medication because you were spending time trying to get food?	0 (0)	3 (15.0)
Competing Money		
Did you miss an appointment with a healthcare provider because you needed to spend money on food rather than spending money either getting to or paying for your appointment?	0 (0)	5 (25.0)
Did you skip a meal or go hungry because you needed to spend money to get to a medical appointment (for instance, bus, train or taxi fare)?	0 (0)	4 (20.0)
Did you skip a meal or go hungry because you needed to spend money on a medical co-payment, or because you had to pay for a medical appointment?	0 (0)	5 (25.0)
Did you skip a meal or go hungry because you spent money on drugs and alcohol and had not enough money left for food?	0 (0)	1 (5.0)
Did you trade food for drugs, alcohol or cigarettes?	0 (0)	1 (5.0)
Did you not fill your antiretroviral (ARV) prescriptions from the pharmacy because you could not afford both food and your medications?	2 (22.2)	5 (25.0)
Did you skip a meal or go hungry because you spent money on getting your ARV prescriptions from the pharmacy?	0 (0)	5 (25.0)

Food Aid

Forty-four percent of food insecure and food secure participants reported receiving

food stamps, vouchers, or coupons during the past year (Table 9). In the previous thirty-

days, 38.9% of food secure and 35.6% of food insecure participants received food stamps.

Forty percent of food insecure participants reported using food aid in the past year whereas

20% reported receiving food aid in the past thirty days. Among food secure individuals, 22%

received food aid in the past year and one individual (5.6%) received food aid in the past

thirty days.

Table 9. Food Stamps and Food Aid Use

	Food Secure (n = 18) n (%)	Food Insecure (n = 45) n (%)
Food Stamps		
Did you receive food stamps, vouchers or coupons at any time over the past year?	8 (44.4)	20 (44.4)
Did you receive food stamps, vouchers or coupons over the past 30 days?	7 (38.9)	16 (35.6)
Food Aid		
Did you or anyone in your household receive food aid at any time during the last year?	4 (22.2)	18 (40.0)
Did you receive food aid over the past 30 days?	1 (5.6)	10 (22.2)

5   Discussion

5.1   Main Findings

Food insecurity has recently been recognized and more widely reported as a modifiable barrier to optimal HIV-related health outcomes. In this thesis, the objectives were to first determine the prevalence and correlates of food insecurity in HIV-positive inpatients at GMH and secondly to investigate the competing demands between food insecurity, drug use, and access to medical treatment and care. To accomplish this, structured interviews were administered for a cross-sectional survey. Seventy-one percent of patients interviewed were food insecure; 44.4% were severely food insecure. Homelessness and monthly income were the strongest correlates of food insecurity, and competing demands seemed to exist for a minority of the food insecure individuals. An equal amount of food secure and food insecure individuals reported using food stamps in the past year, and slightly more food secure participants reported receiving food stamps in the past thirty days.

Prevalence of Food Insecurity

The 71% food insecurity prevalence in this population is five times higher than the prevalence of food insecurity in the general U.S. population, and four times higher than rates reported for the state of Georgia [32]. It is also higher than rates reported in most of the current literature examining food insecurity among HIV-infected populations. In a cohort of marginally housed and homeless HIV-positive individuals in San Francisco, 53% of participants reported experiencing food insecurity, and a study conducted among HIV-positive Atlantans reported a food insecurity prevalence of 52% [5], [23]. In Vancouver, 71% of participants in the British Columbia Drug Treatment program reported experiencing food insecurity [6]. The higher prevalence reported in Vancouver and in this thesis, may be

attributable to the high rates of housing instability and poverty in these two populations [21], [33]. The consistently high prevalence documented in several North American studies suggests that food insecurity may be a significant public health problem for PLWHA in the U.S. and Canada.

A minority of food insecure participants were mildly or moderately food insecure. Forty-four percent of participants were severely food insecure and had reported experiencing hunger in the previous thirty days. This pattern has been seen previously in other HIV-positive populations [10], [28]. A study conducted among crack-cocaine users in Atlanta and Miami reported 34% food insecurity using the question: "In the last 30 days was there any time when you didn't get anything, or barely anything, to eat for two or more days?" Both study samples were recruited from hospitalized HIV-positive populations, a more vulnerable population who may have more limited access to food or HIV-related services than non-hospitalized HIV-positive individuals. These individuals are acutely ill, may not be engaged in regular medical care, and may not be enrolled in available social service programs. This population may be in greatest need of food insecurity interventions, and the hospital setting may be an opportunity for engagement.

Covariates of Food Insecurity

Food insecurity was significantly associated with monthly income, previous homelessness, current homelessness, and was marginally associated with possession of health insurance in unadjusted analysis. However none of these covariates of food insecurity maintained their significance in the multivariate model. This lack of significance is likely due to a lack of statistical power needed to determine significant associations resulting from the small number of patients surveyed. However the covariates which were marginally associated

with food insecurity in this population are consistent with previous findings which have documented strong associations between the same covariates and food insecurity [5], [10], [21].

Ever homelessness was associated with greater than three times increased odds of food insecurity, and current homelessness, although not included in the multivariable analysis, was strongly associated with food insecurity in bivariate analysis. These associations are consistent with findings documented in other food insecurity studies. A study conducted among HIV-positive crack-cocaine users reported that having ever been homeless was associated with nearly four times increased odds of food insecurity [10]. A study conducted in Atlanta documented six-fold increased odds of food insecurity in those that reported worrying about having a place to live in the past year [23]. In British Columbia food insecurity has been documented to have two-fold increased odds of food insecurity among those with unstable housing [21]. The consistent association between both current and ever homelessness and food insecurity illustrate the importance of stable housing in proper access to food. Ever homelessness may be strongly correlated with food insecurity because of the difficulty in obtaining stable housing, food, and income after being homeless. Food insecurity strategies may need to target homelessness in order to be successful. Stronger support from social services may aid in the prevention of homelessness as well as provide skills necessary for currently homeless individuals to obtain stable living conditions.

Monthly income was also strongly associated with food insecurity. A monthly income equal to or greater than $600 was associated with 68% decreased odds of food insecurity. A study conducted among crack-cocaine users in Atlanta and Miami noted the same protective effects with monthly income greater than $600 [10]. However several studies

conducted in similar populations have noted increased odds of food insecurity with low income, including a recently published study in British Columbia where an estimated 70% of HIV-positive individuals live below the poverty line [6] [5]. It is surprising to see any protective effects with the lower limit of monthly income at $600 since this is significantly below the federal poverty line. The link between food insecurity and lower income is well established; however, given the protective effects seen at such a low-income level, it is possible that small fluctuations in income when income is already low are particularly important to subsistence needs. Therefore small amounts of supplemental aid through interventions may have a large impact on food insecurity.

Unexpectedly, having health insurance was associated with three-fold increased odds of food insecurity. This confirms findings from a study among HIV-positive crack-cocaine users where possession of health insurance was associated with over two-fold increased odds of food insecurity [10]. Conversely health insurance has been shown in other studies to be associated with decreased odds of food insecurity. In a cohort of marginally housed and homeless individuals, lack of health insurance was associated with a greater than four-fold increased odds of food insecurity [5]. However less than half of individuals had insurance in this population compared to the 94% with insurance in the cohort of marginally housed and homeless individuals. Even if the populations are socio-demographically similar, having health insurance in the San Francisco cohort may represent general linkage to care and participation in HIV-related health services, which may lessen odds of food insecurity. Hospitalized HIV-positive patients, such as those surveyed for this thesis, often are not linked to care. At GMH, eligible patients who are admitted without insurance are enrolled in Medicaid during their stay. In this setting having health insurance, Medicaid, is not necessarily a marker of linkage to care but rather a by-product of being acutely ill and

hospitalized at GMH. Future research could examine how enrollment in Medicare improves utilization of HIV services or care in this population since the association between odds of food insecurity and possession of health insurance is likely intertwined with the population's overall ability and interest in utilizing health services.

Experience of Food Insecurity

Responses to the HFIAS questions illustrate the diverse experience of food insecurity. Even in this largely food insecure population, most of the food insecurity experiences examined were reported by less than half of participants. However participants of all food insecurity levels (mild, moderate, and severe) reported eating a limited variety of foods. Therefore low variation of foods due to lack of resources may be a good general marker of food insecurity.

A surprisingly low percentage of participants reported worrying about having enough food. Worrying about food access is supposed to precede all other food insecure experiences so one might expect worrying to be reported more than any other experience[13], [15]. However the same proportion of participants that reported worrying about their food supply also reported skipping meals and reducing meal sizes because there was not enough food. The relative lack of worry could be due to knowledge of food aid sources. Food aid such as food banks, soup kitchens, and churches do seem to help a minority of food insecure individuals in this community. Twenty-two percent of food insecure participants reported receiving food aid in the last thirty days and 40% received food aid in the last year. Alternatively, the anxiety associated with lack of access to food may have become so commonplace that participants have normalized the experience and not reported such

anxiety. [13], [15]. Qualitative research could be done to better understand and address factors related to worry over food access.

There was also a marked difference in the number of individuals who reported experiencing the severe food insecurity indicators. The difference in the responses between the severe indicators and all other indicators suggests that those who experience severe food insecurity may be significantly different from other food insecure individuals. This may be true physiologically as well, given the association between severe food insecurity and correlates of HIV progression such as incomplete viral suppression and lower CD4 T-cell counts [27–29]. Therefore when assessing how to best structure food insecurity interventions those who go without food for entire days, go to sleep at night hungry, or experience periods with no access to food may require unique targeted strategies.

Competing Demands

Limited information is known about how food insecurity contributes to compromised medical treatment and care in this hospitalized HIV-positive population. In the general U.S. population, food insecurity has been associated with poor access to outpatient care and higher rates of hospitalizations for acute care [34]. Among HIV-positive Atlantans, food insecurity has been shown to be associated with lack of transportation, running out of medications, and the inability to afford medications [26].

Competing demands between food insecurity and medical treatment exist for a smaller portion of individuals than expected. Interestingly, individuals were just a likely to report forgoing meals to access medical care as they were to miss medical appointments to have enough money for food. This is consistent with studies in resource-poor settings which have demonstrated through longitudinal research that accessing medical care when food

insecure depends on both acute medical need and means to pay for treatment [9]. A hospitalized HIV-positive population characterized by declining health status likely has a greater need for acute care and is therefore more likely than other populations to choose healthcare over food. In addition, severe food insecurity has been associated with less missed medical appointments when compared to mildly and moderately food insecure individuals [9]. The higher prevalence of severe food insecurity seen in this population could also explain prioritization of medical appointments over food. Given this evidence, food insecurity interventions are likely to improve healthcare utilization by eliminating the need to choose between medical treatment and food.

Among those participants who reported using drugs, half reported skipping meals because they spent their money on drugs or alcohol. Food insecure drug users have an added competing demand in addition to healthcare and other subsistence needs, which likely worsen food insecurity. Intervening on food insecurity alone may not be sufficient for this population; i.e. food insecurity may lead to increased drug and alcohol use as a coping mechanism while at the same time creating increased food insecurity due to the extra competing demands in a population with limited resources. Successful improvement of food insecurity in this population will require strategies targeting both drug addiction and food insecurity.

Food insecurity affects medication adherence for participants on ART. While both food secure and food insecure participants reported not filling prescriptions because they could not afford them, only food insecure participants reported skipping meals to fill ARV prescriptions. The relationship between filling ARV prescriptions instead of purchasing food is similar to the pattern noted between healthcare utilization and skipped meals: purchasing

ARV medications instead of food was reported equally as often as purchasing food instead of ARV medications. It is possible that declining health status motivates individuals to choose medication over food. The one-quarter of food insecure participants on ART who reported not being able to afford both food and their ARV medications likely qualify for free medication but are unaware of these services. Improving access and distribution of this information through hospitals, doctors, outpatient clinics, and even health education campaigns could be a simple and low-cost intervention, which could improve ART adherence among HIV-positive food insecure individuals.

Food Stamps and Food Aid

An equal proportion of food secure and food insecure participants reported using food stamps in the previous year. Slightly more food secure participants received food stamps in the past thirty days. Just over one-third of food insecure participants reported receiving food stamps in the last thirty days in comparison to the 84.2% of food insecure participants who reported a monthly income of less than $600, 74.0% of who are unemployed. Interestingly food insecure participants reported using food aid more often in the past thirty days than food stamps. There seems to be a significant underutilization of the current food stamp program, Supplemental Nutrition Assistance Program (SNAP,) especially among the food insecure. The high usage of food aid among food insecure participants in the previous thirty days might have been avoided had these individuals had access to food stamps. Given the surprisingly low prevalence of food stamp use among food insecure individuals, proper access and use of the food stamp program may be able to significantly reduce food insecurity for the mild or potentially even moderately food insecure participants in this population.

Participants' knowledge of SNAP, including the benefits of the program, how to obtain it, how to use it, and any perceived stigma associated with the program were not assessed in this study. However the large number of individuals likely eligible in this population, and the small proportion who reported using these services suggest that information about these programs and help obtaining them is not widely available, making these programs difficult to access. Although not specifically assessed in this study there may also be a small portion of participants who meet the income requirements but are excluded from supplemental food assistance because they are previously convicted felons. Therefore the current eligibility requirements and the low understanding of how to enroll in the program may be creating unnecessary barriers to services meant to provide assistance to the public. Future research could aid in determining how much is known about SNAP and available food aid within this community in order to address these barriers.

5.2   Strengths and Limitations

This thesis has several strengths. First, this thesis directly examines competing demands between food insecurity, access to care, and drug use which few other studies among HIV-positive populations have done. Much of the previous food insecurity research among HIV-positive populations have focused on determining prevalence and correlates of food insecurity but have not examined specific trade-offs, which many occur in the setting of food insecurity. Second, the questionnaire used for the food insecurity assessment is a previously validated questionnaire; it was simple to use, culturally relevant, and easily understood. These all helped improve the confidence of the food insecurity categorization. The different options for response (never, rarely, sometimes, and often) included in the

questionnaire also allowed a clear and precise understanding of how food insecurity is experienced in this population.

There were also several limitations to this study. This thesis relied on cross-sectional data and therefore no causality can be inferred. In addition, the small sample size reduced the ability to determine statistical significance of associations, which could be present in this population. Since a small portion of the population reported experiencing the competing demands asked, the sample size made it difficult to fully illustrate the existing competing demands. In addition, since participants were informed of the study topic prior to completing the questionnaire they could have modified their responses to reflect increased food insecurity severity or modified experiences in the competing demands section. Finally, many of the patients were acutely ill, and while interested in completing the questionnaire, at the end of the interview session they may have tired of answering questions. This may have affected the validity of some questions; however, measures were taken to try to prevent this. During the introduction period prior to the interview, participants were informed that they could stop the interview at any time for any reason. In addition, interviewers were mindful of the health of the patients and offered to come back at a later time if they noticed the participant becoming tired.

5.3   Public Health Implications

Food insecurity is common experience for HIV-positive patients at GMH. The prevalence of food insecurity seen in this population is significantly higher than the prevalence in the general U.S. population and higher than other prevalence estimates among PLWHA. As in other studies there was a clear relationship between limited resources, housing instability, and increased food insecurity.

National and local services exist to provide services to PLWHA; however given the high rates of food insecurity, the effects of these available services need to be evaluated to determine if additional services are needed, available services need to be optimized, or more population specific interventions are necessary. Future research working towards improvement in enrollment, education, and access to these resources could help individuals better utilize existing programs.

The evidence of a protective effect of increased monthly income suggests that small amounts of economic assistance may have a great impact on food insecurity. Improving food insecurity may also affect healthcare utilization given the competing demands between food and medical treatment. Additional research is needed to fully understand the relationship between food insecurity and HIV clinical outcomes. Longitudinal studies are necessary to understand the temporal variation of food insecurity and to better explore causal relationships between food insecurity and markers of HIV disease progression or severity. Lastly, qualitative research would be particularly necessary in order to more fully describe competing demands that may not be covered in structured questionnaires. Determining the demands that contribute to increased food insecurity, decreased medical care, or decreased medication adherence are essential to the proper design of food insecurity interventions.

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Appendix I: HFIAS Questionnaire

For each of the following questions, consider what has happened ins the past 30 days. Please answer whether this happened never, rarely (once or twice), sometimes (3-10 times), or often (more than 10 times) in the past 30 days.

1. Did you worry that you would not have enough food?

2. Were you not able to eat the kinds of foods you preferred because of a lack of resources?

3. Did you eat just a few kinds of food day after day due to a lack of resources?

4. Did you eat food that you preferred not to eat because a lack of resources to obtain other types of food?

5. Did you eat a smaller meal than you felt you needed because there was not enough food?

6. Did you eat fewer meals in a day because there was not enough food?

7. Was there ever no food at all where you stay because you did not have resources to get more?

8. Did you go to sleep at night hungry because there was not enough food?

9. Did you go a whole day without eating anything because there was not enough food?

Appendix II: HFIAS Category Formulas

Food insecurity categories (mild, moderate, and severe) in this thesis were calculated using the formulas below. Responses of never = 0, rarely = 1, sometimes = 2, and often = 3. After using the formulas participants in categories two, three, and four are classified as food insecure.

HFIA category	Calculate the Household Food Insecurity Access category for each household. 1 = Food Secure, 2=Mildly Food Insecure Access, 3=Moderately Food Insecure Access, 4=Severely Food Insecure Access HFIA category = 1 if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0] HFIA category = 2 if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0] HFIA category = 3 if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0] HFIA category = 4 if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3]