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**Social determinants, lived experiences, and consequences of household food insecurity among persons living with HIV/AIDS on the shore of Lake Victoria, Kenya**

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**Abstract**

Food insecurity is a considerable challenge in sub-Saharan Africa, disproportionately affecting persons living with HIV/AIDS. This study investigates the lived experience, determinants, and consequences of food insecurity and hunger among individuals living with HIV/AIDS in Suba District, Kenya. Parallel mixed methods included semi-structured interviews and administration of the Household Food Insecurity Access Scale among a systematic sampling of 67 persons living with HIV/AIDS (49 of whom were receiving antiretroviral therapy (ART)). Respondents were either severely (79.1%) or moderately (20.9%) food insecure; no respondents were mildly food insecure or food secure. Qualitative data and simple and multiple linear regression models indicated that significant determinants of food insecurity include increased age, a greater number of children, and not being married. A number of themes related to food insecurity and ART emerged, including (1) an increase in hunger or appetite since initiating ART; (2) exacerbation of ART-related side effects; and (3) non-adherence to ART due to hunger, food insecurity, or agricultural work responsibilities. HIV interventions should address food insecurity and hunger, particularly among at-risk populations, to promote ART adherence and better health outcomes.

Keywords: food insecurity; hunger; HIV/AIDS; anti-retroviral agents; social determinants; Kenya; sub-Saharan Africa

## **Background**

Food insecurity, characterized by insufficient quantity or quality of food, reductions of food intake, and feelings of uncertainty, anxiety, or shame over food (Coates, Swindale, & Bilinsky, 2007), is a leading cause of global mortality and morbidity which affects an estimated 239 million people in sub-Saharan Africa (FAO, 2010; Lartey, 2008). Food insecurity in sub-Saharan Africa stems from a host of factors, including frequent drought, macroeconomic imbalances in trade, gender inequality, and poor education (Mwaniki, 2006). Furthermore, food insecurity disproportionately affects the estimated 22.5 million persons living with HIV/AIDS in sub-Saharan Africa (Mwaniki, 2006; UNAIDS, 2010).

At the household level, the presence of even one individual living with HIV/AIDS can jeopardize the food security of an entire household. For example, a person living with HIV/AIDS may experience a loss of income due to HIV-related symptoms, psychosocial issues, or adverse effects of medications including nausea and vomiting; loss of income, in turn, may lead to reduced food intake for an entire household (Bukusuba, Kikafunda, & Whitehead, 2007; Haddad & Gillespie, 2001). Lack of food can lead to risky coping strategies in the household which may increase economic vulnerability or exposure to HIV, including the redirection of wage labor or the exchange of sex for money or food (Fenton, 2005; Gillespie & Kadiyala, 2005; Weiser et al., 2007). Assets may be sold to pay for medical care or children may be removed from school due to the lack of available funds or the need for additional labor, leading to worsening cycles of poverty (Ivers et al., 2009).

In the general population, determinants of food insecurity include markers of low socio-economic status such as less education, low income, fewer assets, and unemployment in both developed (Foley et al., 2010; Furness, Simon, Wold, & Asarian-Anderson, 2004; Vosoris &

Tarasuk, 2003; SD Weiser et al., 2009) and developing (Knueppel, Demment, & Kaiser, 2010; Mohammadzadeh, Dorosty, & Eshraghian, 2010) countries. Household food insecurity has also been found to be positively associated with household size (Mohammadzadeh, Dorosty, & Eshraghian, 2010), number of children (Foley et al., 2010), and age (Knueppel, Demment, & Kaiser, 2010; Laraia, Siega-Riz, Gunderson, & Dole, 2006; Leyna, Mmbaga, Mnyika, Hussain, & Klepp, 2010). Married men and women have reported higher levels of food security than their never married, cohabiting, separated, and divorced counterparts (Hanson, Sobal, & Frongillo, 2007).

Some studies have investigated determinants of food insecurity among persons living with HIV/AIDS (PLWHA) in the USA (SD Weiser et al., 2009), but data are limited on correlates of food insecurity among PLWHA in sub-Saharan Africa. The limited data available suggest that food insecurity is a barrier to adherence to antiretroviral therapy (ART) in the USA (Proctor, Tesfa, & Tompkins, 1999; SD Weiser et al., 2009), Uganda (Weiser et al., 2010) and elsewhere in sub-Saharan Africa (Hardon et al., 2007).

To our knowledge, this is the first study to examine household food insecurity among PLWHA in Kenya, and the first mixed methods study to examine determinants and consequences food insecurity among PLWHA in sub-Saharan Africa. HIV/AIDS is intrinsically connected to food security and hunger, but little is known about the nature of the multidirectional relationships. Examining the prevalence of food insecurity and its demographic and socio-economic correlates are essential for identifying PLWHA at risk for wasting, undernutrition, poor adherence, and poor health outcomes (SD Weiser et al., 2009). Furthermore, qualitatively investigating of the lived experience of hunger among PLWHA is important for guiding policies for ART and nutrition support programs.

The objectives of this study were to determine the prevalence of food insecurity among PLWHA, to identify demographic and socio-economic correlates of food insecurity among PLWHA, and to explore the lived experience and consequences of food insecurity among PLWHA receiving ART.

## **Methods**

### ***Study Community***

This study was conducted in Mfangano Island, Suba District, Nyanza Province, Kenya. Mfangano Island is located between longitudes 33°55' E and 34°6' E and latitudes 0°25' S and 0°30' S, and is one of 16 islands in Suba District located in Lake Victoria. Approximately 19,000 people live on the island, most of whom belong to the Suba or Luo ethnic groups. Luo is the most commonly spoken language.

Suba District is one of twelve districts in Nyanza Province, located in the Lake Victoria Basin. The Lake Victoria basin receives approximately 750-1000 mm of rainfall every year. Two rainy seasons exist; the 'long rains' peak in April and the 'short rains' peak in October (Survey of Kenya, 1970). In Suba District, 32.9% of residents are infected with HIV and 80% of hospital beds are occupied with AIDS-related illness (NASCO, 2005). Subsistence farming and fishing are the major occupations for most residents. Wild plants and fruits are important in Luo diets and may be particularly important during periods of food shortage (Johns & Kokwaro, 1991).

### ***Participants***

Inclusion criteria for eligible study participants included being older than 18 and being HIV-infected. Eligible respondents also had to be a patient at the Family AIDS Care and

Education Services (FACES) Sena Clinic in Mfangano Island. FACES is affiliated with the Kenya Medical Research Institute and the University of California, San Francisco and is the only program that currently distributes ART on Mfangano Island.

Biomedical health care providers at the FACES clinic conducted systematic sampling by asking every second man and every second woman meeting the inclusion criteria to participate in a research study about HIV/AIDS and hunger.

### ***Ethics***

Ethical approval for this research was provided by the Central University Research Ethics Committee at the University of Oxford and the Suba District Medical Officer of Health in Nyanza Province. Informed consent was obtained verbally.

### ***Study Design and Data Collection***

The study was cross-sectional and used parallel mixed methods, including surveys and interviews with both quantitative and qualitative components (Creswell, Plano Clark, Gutmann, & Hanson, 2003). Interviews were conducted using a semi-structured questionnaire consisting of open- and closed-ended questions and lasted an average of 30 minutes. Interviews were conducted from 08:00 to 13:00 Monday through Thursday (clinic hours) in March and April 2009. All interviews were conducted in private offices on the premises of the FACES clinic, instead of in the individual's house to minimize stigma associated with identifying an individual as HIV positive. Interviews were conducted in the respondent's preferred language, either Luo or English. Luo responses were translated into English for analysis. The first author conducted all

interviews and the second author, fluent in both English and Luo, assisted in translation of the interviews when necessary.

Food insecurity was measured using the nine-item Household Food Insecurity Access Scale (HFIAS) developed by the USAID Food and Nutrition Technical Assistance (FANTA) project (Coates, Swindale, & Bilinsky, 2007). The HFIAS, which has been validated in both developed and developing regions (Coates et al., 2006; Frongillo & Nanama, 2006; Knueppel, Demment, & Kaiser, 2010; Melgar-Quinonez et al., 2006; Swindale & Bilinsky, 2006; Webb et al., 2006; SD Weiser et al., 2009), includes questions in three food insecurity domains: anxiety and uncertainty about the food supply, insufficient food quality, and insufficient food intake and its physical consequences (Coates, Swindale, & Bilinsky, 2007). The semi-structured survey instrument was developed iteratively over several weeks in conjunction with key informants and pretested with seven informants not involved in the study, in accordance with the HFIAS Indicator Guide (Coates, Swindale, & Bilinsky, 2007). For each of the nine questions, interviewees were asked if they experienced each item never, rarely (once or twice), sometimes (three to ten times), and often (more than ten times) in the past month. Never, rarely, sometimes, and often were then coded as 0, 1, 2, and 3, respectively. When summed, the scores ranged from 0 to 27, the higher number representing the highest levels of food insecurity. Individuals were then categorized into four levels of food insecurity: food secure, mildly food insecure, moderately food insecure, and severely food insecure in accordance with the HFIAS Indicator Guide (Coates, Swindale, & Bilinsky, 2007).

Additionally, among those PLWHA on ART, qualitative data on the lived experience and consequences of hunger were collected. A topic guide was created based on inputs from key informants and included questions about the experience of hunger in general, hunger while on



ART, hunger among one's family, nutrition recommendations, side effects of ART, and adherence to ART.

Demographic, socio-economic, and ART variables were selected based on previous food insecurity literature (Knueppel, Demment, & Kaiser, 2010; Laraia, Siega-Riz, Gunderson, & Dole, 2006; Leyna, Mmbaga, Mnyika, Hussain, & Klepp, 2010; Mohammadzadeh, Dorosty, & Eshraghian, 2010) and included age, gender, number of children, marital status, years of schooling, ART usage, and ever skipped a dose of ART.

### ***Data Analysis***

Quantitative statistical analyses were conducted with SPSS 12.0 for Windows (SPSS Inc., Chicago, IL) with the level of significance set at  $p < 0.05$ . Simple linear regression was performed with the HFIAS score (continuous) as the dependent variable, and demographic, socio-economic, and health status measures as the independent variables. A backwards stepwise regression was utilized to determine significant variables in a multiple linear regression model.

Grounded theory was used to analyze qualitative data (Lingard, Albert, & Levinson, 2008; Strauss & Corbin, 1998). Open-ended interviews were initially hand coded to generate a master set of codes. Major themes related to food insecurity, ART, socio-demographics, and adherence were discerned utilizing coding and analytic memos. Frequencies of each theme were then tabulated using a computer spreadsheet. The emergent themes were then examined for commonalities, disagreements, and variations.

### **Results**

Seventy patients were approached, 51 female and 19 male. Because the FACES patient population on the island is predominantly female, this proportion is representative of those in care. Sixty-seven (95.7% response rate) consented to participate, 49 of whom were receiving ART and 18 on supportive HIV/AIDS treatment (like trimethoprim-sulfamethoxazole) but not receiving ART.

The average age of the sample was 34.7 and a majority (73.1%) was female (Table 1). Respondents on average had 2.9 children. Over three-quarters of the sample were married (77.6%) while a minority was widowed (16.4%) or single (6.0%). In terms of socio-economic status, the mean years of schooling was 6.93.

Table 1. Selected food security, demographic, socioeconomic characteristics of study participants.

Variable	<i>n</i>	Percentage	Mean	SD	Range
<i>Household food insecurity</i>					
Household food insecurity access scale score	67		13.0	5.1	2–23
<i>Household food insecurity access scale prevalence</i>					
Food secure	0	0.0%			
Mildly food insecure	0	0.0%			
Moderately food insecure	14	20.9%			
Severely food insecure	53	79.1%			
<i>Demographic characteristics</i>					
<i>Gender</i>					
Female	49	73.1%			
Male	18	26.8%			
Age	67		34.7	10.5	18–60
<i>Marital status</i>					
Single	4	6.0%			
Married	52	77.6%			
Widowed	11	16.4%			
Number of children	67		2.9	1.9	0–9
<i>Socioeconomic status</i>					
Schooling (years)	67		6.9	3.6	0–14
<i>Antiretroviral therapy</i>					
<i>Current ART usage</i>					
Yes	49	73.1%			
No	18	26.8%			

### ***Characterization of Food Insecurity***

The average HFIAS score among PLWHA was 12.96 (Table 1). In terms of household food insecurity access prevalence categories, 79.1% of respondents were severely food insecure,

20.9% of respondents were moderately food insecure, and no respondents were mildly food insecure or food secure.

Overall, a majority of respondents reported experiencing each of the nine food insecurity conditions (as defined by the HFIAS) in the past month except for the final item, going a whole day and night without eating (Figure 1). Among the nine household food insecurity-related conditions, respondents most often experienced eating a limited variety of foods due to a lack of resources, and least often experienced going a whole day and night without eating anything because there was not enough food.

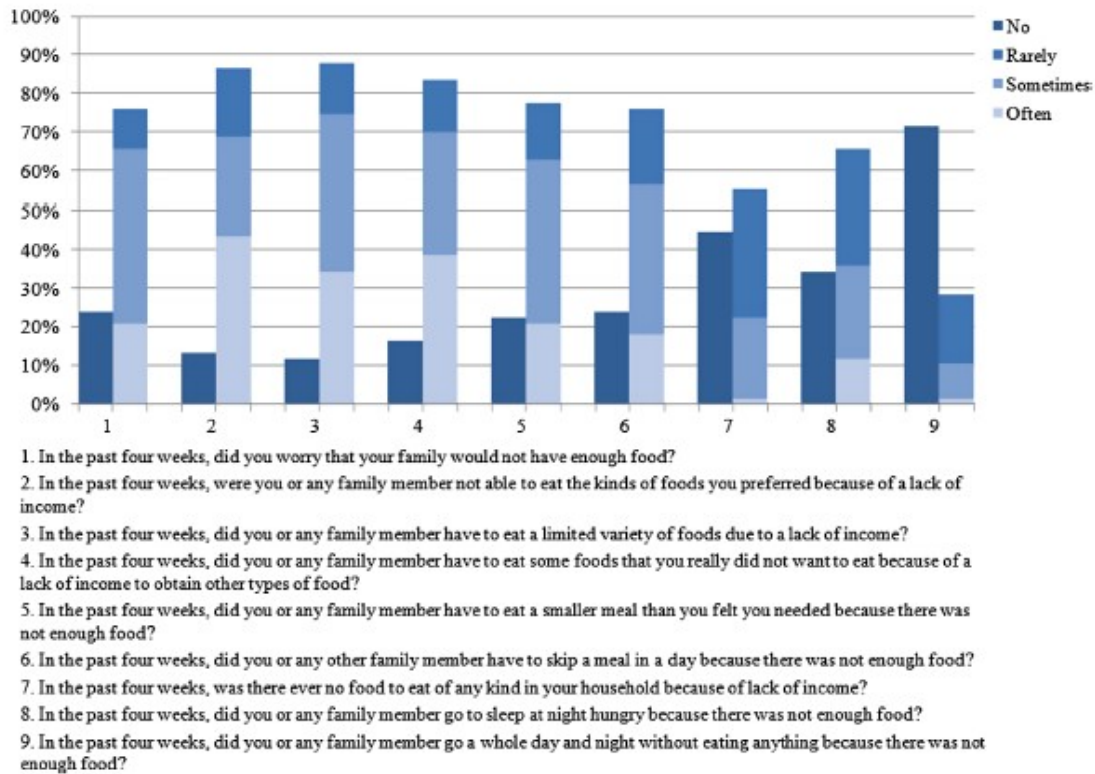


Figure 1. Household food insecurity access-related items.

***Determinants of Food Insecurity***

Qualitative data indicated that large family size, lack of a spouse, and old age contributed to food insecurity (Figure 2). In simple and multiple linear regression models of food insecurity, these three demographic variables were significantly associated with higher levels of food insecurity (higher HFIAS score). Gender, education, and ART use were not found to be significantly associated with the HFIAS score (Table 2).

Table 2. Results from simple and multiple linear regression with Household Food Insecurity Access Scale score (HFIAS Score) as the dependent variable, and various measures of socioeconomic status and demographics as independent variables.

	Simple linear regression				Multiple linear regression <sup>a</sup>			
	B(SE)	Intercept	R <sup>2</sup>	p	B(SE)	Intercept	R <sup>2c</sup>	p
<b>Determinants</b>								
<i>Socio-demographic</i>								
Age	0.17 (0.06)**	7.16	0.11	<0.01**	0.10 (0.05)*	9.62	0.40	<0.01**
Gender	1.23 (1.40)	12.06	0.01	0.38				
Children <sup>b</sup>	1.10 (0.30)**	9.82	0.17	<0.01**	1.16 (0.29)**	9.62	0.40	<0.01**
Married	-3.41 (1.44)*	15.60	0.08	0.02*	-4.54 (1.25)**	9.62	0.40	<0.01**
Schooling <sup>c</sup>	-0.28 (0.17)	14.86	0.04	0.11				
<i>Antiretroviral therapy</i>								
ART usage	2.14 (1.38)	11.40	0.04	0.13				

<sup>a</sup>Multiple linear regression model included age, children, and marital status.

<sup>b</sup>number of children in household.

<sup>c</sup>number of completed years of schooling.

\* $p < 0.05$ ; \*\* $p < 0.01$ .

### Family size

In the simple linear regression model, each additional child was associated with a 1.10 unit increase in the HFIAS score ( $p < 0.01$ ). In interviews, respondents described concern over feeding their children, particularly in families with many children. Some respondents reported sacrificing their own food intake so that their children could eat sufficiently.

“I have been taking ARV’s for one and a half years and they have been good. I even take ARV’s on an empty stomach sometimes so my kids can eat more. Kids don’t understand why there is no food. Not knowing how to get food is very hard” (Female ART patient, married, age 34, 4 children).

Others expressed shame and dissatisfaction over providing their family with the same plain food every day. Larger families often sacrificed diversity in order to provide sufficient quantity of food to serve a whole family.

“Sometimes we eat *omena* [small fish] every day – we don’t even have cooking oil so we just boil it in water. You just eat for the sake of eating, but you don’t really like it. Inwardly, you don’t feel like giving the family that food or having it for yourself” (Female ART patient, widowed, age 33, 6 children).

### *Marital Status*

Being married was associated with a 3.41 decrease in the HFIAS score ( $p=0.02$ ) in the simple linear regression model of food insecurity. Some respondents explained the additional challenge of acquiring food for a household without the support of a spouse. Women who were widowed, single, or not receiving financial support from a breadwinner in particular discussed these challenges.

“My husband died. It has been tough; not because of HIV but because of income. Unless you have someone working for an income it is not easy to provide for your family. We sometimes go without eating anything” (Female ART patient, married, age 28).

Single women similarly relied on parents, particularly fathers, for food and financial support. “I had some differences in the house with my father so my sisters and I did not eat much for a week” (Female ART patient, single, age 23).

### *Older Age*

A one year increase in age was associated with a 0.17 unit increase in the HFIAS score in simple linear regression ( $p < 0.01$ ). This was borne out in qualitative data; PLWHA describe the increasing difficulty in completing agricultural labor and therefore producing food as they grow older.

“Work is hard; it is more difficult now than it has ever been before. At times, I’m too tired. I work slower on the farm than I did in the past so it takes me longer to harvest crops” (Female ART patient, married, age 59).

Multiple linear regression was performed to control for confounding and to find a combination of variables that best predicted the HFIAS score. In backwards stepwise linear regression age, number of children, and being married remained associated with the HFIAS score ( $p < 0.01$ ). Holding children and marital status constant, each additional year of life was associated with a 0.10 increase in the HFIAS score. Holding age and marital status constant, an additional child was associated with an increase in HFIAS score of 1.16. Finally, holding age and number of children constant, being married was associated with a 4.54 reduction in the HFIAS (Table 2).

### ***Consequences of Food Insecurity among Persons on Antiretroviral Therapy***

Three themes related to the consequences of food insecurity among PLWHA receiving antiretroviral therapy emerged: (1) an increase in hunger or appetite since initiating ART ( $n=41$ ); (2) exacerbation of ART gastrointestinal side-effects ( $n=15$ ); and (3) skipping a dose of ART for any reason ( $n=20$ ) or directly due to hunger, food insecurity, or agricultural work responsibilities ( $n=8$ ) (Table 3).

Table 3. Number of ART patients who identified hunger and food insecurity related themes.

	Identified	Disagreed	Not addressed
<i>Hunger and ART</i>			
Increased hunger while on ART	41 (84%)	4 (8%)	4 (8%)
Immediate change in hunger when starting ART	14 (29%)	2 (4%)	33 (67%)
Increased frequency of eating	11 (22%)	4 (8%)	34 (69%)
<i>ART side-effects</i>			
Nausea, vomiting, gastrointestinal side-effects	15 (31%)	4 (8%)	30 (61%)
<i>ART adherence</i>			
Ever skipped a dose of ART	20 (41%)	29 (59%)	0 (0%)
Ever skipped ART due to hunger, food insecurity, agriculture	8 (16%)	36 (74%)	5 (10%)

### 1. Increased hunger and appetite after ART initiation

A majority of respondents (84%) described an increase in hunger since initiating ART, beyond hunger levels experienced before starting ART.

“I feel very hungry when it is the time to take meals. I feel the stomach is really burning” (Female ART patient, married, age 39).

Respondents also experienced an increased appetite (n=16). An increased appetite often led to increased hunger as additional food was not always available. Some believed the increased appetite was due to the powerful nature of the ART drugs. “I experienced an increase in appetite, so I needed something to eat after every short time. I just felt hungry” (Female ART patient, married, age 28). “Before I started ARV's, I didn't have much appetite. Once I started, I gained an appetite” (Male ART patient, married, age 34).

For many PLWHA on ART, the increased hunger was experienced as an immediate change after initiating ART (29%). The hunger, appetite, and other changes experienced on the first few days of ART were particularly memorable to respondents.

“On the day I started ARV's, I felt very hungry. On the second day, I felt very, very hungry” (Male ART patient, married, age 49).

Persons receiving ART who experienced an increase hunger and appetite after initiating ART described different coping strategies to deal with the hunger. One respondent explained that he chose to skip morning meals rather than evening meals, because he was able to cope with hunger better during the day than at night. “The appetite is there but you also get much hunger because these are powerful drugs. I have found that supper is the most important meal. If you skip supper, you will not sleep well. You will have ulcers. You cannot sleep. It is better to skip the morning meals rather than the evening ones. During the day, you can ignore the hunger by eating with your eyes. You can talk to people, look at foods, swim, or work at the farm. But at night, I am telling you that you will not be able to sleep. You will have problems” (Male ART patient, married, 38).

Increasing the frequency of eating (22%) was another strategy to respond to increased hunger. “When I started ARVs, I felt a lot of hunger. I needed to eat more frequently than usual. I am not currently in a condition to work and I don’t have someone to provide for me. I don’t have income so I survive with one meal per day – and it’s just vegetables and plants that are available to pick for free. The hunger becomes difficult because I am not in a position to get the foods I want. But I just take the ARVs even if I don’t have food” (Female ART patient, widowed, age 48).

In contrast, a minority of respondents (8%) reported decreased hunger or the “disappearance” of hunger after initiating ART. “I was tested one day, and immediately I found out that I was HIV positive. I started getting septrin and multivitamins. Soon after, I was told to start taking ARV's. Since starting on ARV's, I have not felt any kind of sickness. When I take ARV's, I just feel like the hunger disappears” (Female ART patient, widowed, age 33).



## 2. *ART side effects*

Gastrointestinal side-effects of ART affected appetite, hunger, and food consumption in 31% of respondents. In order to reduce side effects, respondents often reported taking ART with food.

“Yes, at times I have to take drugs with porridge. If I take them with water I vomit. My appetite has really increased. I want to eat something after a short period” (Female ART patient, married, age 29).

“I had pangs in my lower abdomen. Immediately I drank soda to get some relief. After three days, I was feeling very fatigued. My belly felt as if it was being constantly pumped. I felt a lot of pain. The following day I started diarrhea, which continued for two days. I had been instructed about these side effects. Now I’m just okay, but I can’t pass more than three or four hours without something to eat, I am so hungry” (Male ART patient, married, age 48).

Some respondents who took certain ART on an empty stomach reported exacerbated side effects, particularly gastrointestinal problems. “After taking the ARV pills in the morning, I sometimes feel more hungry than before. I usually take the pills before eating anything, so I will sometimes have a stomach ache or feel nausea” (Male ART patient, married, age 33).

## 3. *Hunger and adherence*

Nearly a third of respondents (31%) reported skipping at least one ART dose and 40% of these respondents cited reasons related to hunger, food insecurity, or food production work. Because some ARV’s should be taken with food, respondents without access to sufficient food reported occasionally skipping the drugs.

“When you take these drugs, you feel so hungry. They are so powerful. If you take them on an empty stomach they just burn. I found that sometimes I would just skip the drugs, but not tell anyone. These are some of the things that make it difficult to survive” (Male ART patient, married, age 33).

“There was a time when I defaulted. I slept hungry. The following morning, after just seeing the drugs I felt like vomiting on an empty stomach. I stopped for one month. When I came back to the clinic for another supply I was not treated well because I had skipped. I started again and defaulted again” (Female ART patient, married, age 28).

In contrast, a majority (59%) of respondents reported never skipping a dose of ART, even if they experienced hunger.

“Even if I’m very much hungry, I just take the drugs. I must take the drugs no matter what” (Male ART patient, married, age 47).

“I have never skipped the ARV’s. Even if I go to sleep hungry, I will force myself to take the drug” (Female ART patient, married, age 35).

## **Discussion**

Severe and moderate food insecurity was universal among PLWHA in rural Suba District. To our knowledge, this is the first study to evaluate the experience of food insecurity and its correlates among PLWHA in Kenya. Among the nine items within the HFIAS, respondents most often experienced eating a limited variety of foods due to a lack of resources, and least often experienced going a whole day and night without eating anything because there was not enough food. Food insecurity levels in this study among PLWHA were higher than food insecurity levels reported in other parts of sub-Saharan Africa (Knueppel, Demment, & Kaiser,

2010; Mamlin et al., 2009). Rural areas may have higher levels of food insecurity due to higher levels of poverty, smaller plots of land per family, and poor soil quality (Mamlin et al., 2009).

This study points to several determinants and consequences of household food insecurity among PLWHA (Figure 2). Having more children, being single or widowed, and being older may lead to increased household food insecurity. Among persons receiving ART, household food insecurity may lead to increased hunger and appetite, as well as increased gastrointestinal side effects, which both in turn may decrease adherence to ART.

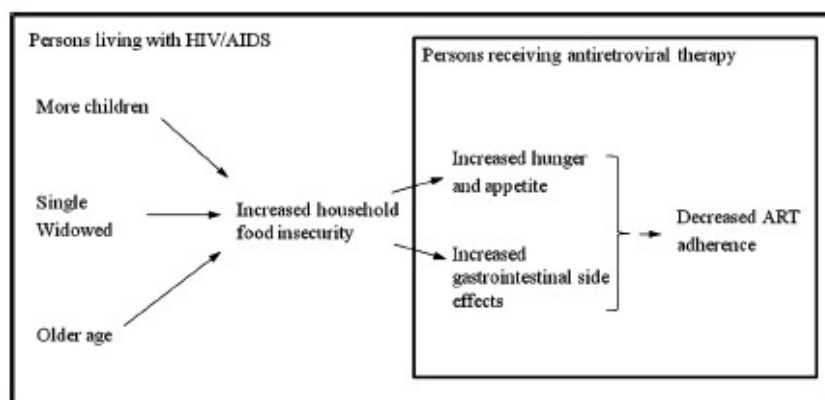


Figure 2. Determinants and consequences of household food insecurity in Suba District, Kenya.

Our finding that food insecurity was associated with a larger number of children among PLWHA in western Kenya was comparable to previous studies in non HIV-infected populations (Foley et al., 2010). Particularly during famine or the hungry season, a larger number of children and therefore a larger household may mean less food consumption for each family member (Chaput, Gilbert, & Tremblay, 2007; Mohammadzadeh, Dorosty, & Eshraghian, 2010; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). Food insecurity was less severe among married PLWHA in Suba District, similar to findings in non-HIV positive populations (Hanson, Sobal, & Frongillo, 2007). Marriage can enhance family income and wealth (Light, 2004; Waite, 1995), allow for the sharing of resources (Hanson, Sobal, & Frongillo, 2007), and

provide social support (Cutrona, 1996), which all may contribute to improved food security. Food insecurity was positively associated with age among PLWHA. Older individuals living with HIV/AIDS reported challenges in working on farms and producing income or food for the family. In addition, elders may be more susceptible to disease, retired, or dependent on others for food which might explain their higher levels of food insecurity. Other studies have reported similar associations between food insecurity and age in non HIV-positive populations (Knueppel, Demment, & Kaiser, 2010; Laraia, Siega-Riz, Gunderson, & Dole, 2006; Leyna, Mmbaga, Mnyika, Hussain, & Klepp, 2010).

In addition to investigating possible causes of food insecurity, in our open-ended questions we elicited some possible consequences of food insecurity among participants. Household food insecurity contributed to increased hunger and appetite among PLWHA, as well as increased gastrointestinal side effects. Both of these factors contributed to decrease adherence to ART among participants interviewed. Specifically, 40% of respondents who reported skipping at least one ART dose cited hunger, food insecurity, and agricultural work as reasons for poor ART adherence. These findings are similar to those of a previous study in rural Uganda, which reported several possible mechanisms explaining food insecurity as a barrier to ART adherence including increased appetite leading to intolerable hunger while on ART, exacerbated ART side effects in the absence of food, competing medical and food expenses, and forgetting to take ART while working long hours in the fields (Weiser et al., 2010). In addition to the problems with non-adherence, inadequate food intake is also problematic among PLWHA as poor nutritional status increases susceptibility to infection, morbidity, and mortality (Van Der Sande et al., 2004; Villamor, Saathoff, Kanji, Hunger, & Fawzi, 2005).

This study's cross-sectional design precludes any causal inferences. Because interviews occurred at the clinic and were not conducted with patients who were lost to follow-up, transferred, or deceased, food insecurity and hunger levels may have been underestimated (Weiser et al., 2010). In addition, the lack of variability among food insecurity in the sample may have made it difficult to detect correlates of food insecurity. As the study was conducted in a rural island community in western Kenya with a relatively small sample size, results may not be generalizable to other populations more urban or on the mainland with improved transportation. Despite these limitations, the food insecurity instrument (HFIAS) was designed for cross-cultural settings, has been validated in rural sub-Saharan Africa, and was pre-tested with key informants in Mfangano Island. In addition, the strengths of the study include mixed qualitative and quantitative methods, which allowed for statistical testing supported by qualitative analysis.

## **Conclusion**

Food insecurity was universal among PLWHA in Suba District, and its severity was associated with increased age, greater number of children, and not being married. Persons receiving ART described lived experiences and consequences of food insecurity while on ART, citing an increase in hunger after initiating ART; exacerbated ART side-effects; and non-adherence to ART due to hunger, food insecurity, and agricultural work responsibilities. Nutritional and agricultural interventions targeted to the populations most likely to be food insecure have the potential to decrease food insecurity and hunger, leading to enhanced ART adherence and improved health outcomes. The reduction of food insecurity may be imperative to the success of HIV/AIDS support programs and should be considered when planning these programs. Through partnerships between government agencies, non-governmental organizations,

and communities, countries need to develop and expand nutritional, agricultural and structural interventions to radically improve food insecurity and reduce hunger. Access to food and healthcare are considered essential human rights (UN, 1948). Thus governments and the international community have the responsibility to ensure adequate access and supply of food; doing so will also aid in improving health, especially for PLWHA and those at risk of HIV infection.

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