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FOOD INSECURITY AND ITS RELATION TO PSYCHOLOGICAL WELL-BEING AMONG SOUTH INDIAN PEOPLE LIVING WITH HIV

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Abstract

Food insecurity (FI) and its link with depression and quality of life (QOL) among people living with HIV (PLHIV) in India are not well-documented. We analyzed cohort data from 243 male and 129 female PLHIV from Bengaluru, and found 19% of men and 26% of women reported moderate or severe FI over a six-month period. Women reported higher mean depression than men, and lower mean QOL. In multivariate analyses adjusting for HIV stigma and demographic covariates, both male and female PLHIV with moderate to severe FI showed lower mean QOL than those reporting mild to no FI. Male but not female food insecure participants also had higher depression scores in adjusted regression analyses. As ART has improved the physical health of PLHIV, more effort is being invested in improving their psychological well-being. Our results suggest such interventions could benefit from including nutritional support to reduce FI among PLHIV.

Keywords

HIV; food insecurity; depression; quality of life; India

Introduction

Food insecurity (FI) is a condition in which the availability of nutritionally adequate and safe foods or the ability to obtain acceptable foods in a socially acceptable way is limited or uncertain (1). FI is the plight of many people living with HIV (PLHIV). Studies from Sub-Saharan Africa generally report at least a third to one half of their PLHIV samples to be food insecure (2–5), with several reporting over three-quarters of PLHIV being food insecure (6–10). In resource-rich settings, where evidence is often from marginalized populations in urban settings, recent FI prevalence estimates among PLHIV range from 24% to 80% (11–19). FI and HIV are intertwined in a vicious cycle with one affecting, and in turn being affected by, the other (20). Via nutritional (21, 22), mental health (e.g., depression, anxiety (23, 24)) and behavioral pathways (risky sexual behavior, poor ART adherence (25, 26)), FI

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can increase the risk of HIV acquisition or transmission, and hasten disease progression once a person is HIV infected. Conversely, health care related costs of PLHIV, HIV-related stigma, or the reduced capacity to work due to illness, can lead to loss of income or of food produced for consumption, and increase FI (20).

The link between FI and reduced mental health has been shown in studies of both PLHIV (13, 23, 24, 27, 28) and non-PLHIV (29–31). More generally, quality of life (QOL) and life satisfaction have been found to be impaired by FI as well (8, 32–34). For PLHIV, mental health and QOL can additionally be influenced by HIV related stigma, i.e. the socially devalued status associated with HIV infection, which can manifest itself as prejudice, discrediting, and discrimination of PLHIV. Actual experiences of stigmatization, as well as the anticipation of stigma and the internalization of such negative beliefs, have been shown to be related to symptoms of depression (35–39) and lower QOL (40–43).

The abovementioned evidence on the links of both FI and stigma with depression and QOL is mostly from sub-Saharan Africa and North America. For India, where an estimated 2.1 million people are infected with HIV (44) and 17.5% of the population is undernourished (45), few studies have been reported. There are some previous studies confirming the relationship between HIV stigma and depression and QOL in India (39, 40, 46–49), or documenting the nutritional status of PLHIV (50–52), but to our knowledge, only two studies have been published on Indian PLHIV's food insecurity, a construct that assesses perceived insufficiencies in the quality and quantity of food available rather than the physical consequences of actual food intake. Both studies have limited generalizability. One study focused only on prevalence of malnutrition and FI among male drug users in Tamil Nadu, finding that 69% of PLHIV in their sample (n=68) were food insecure (53). The other study was limited to low-income households with children connected to a network for PLHIV in Maharashtra, and all but one were food insecure. It therefore only was able to compare very low to low food security status, and the correlates were limited to socio-economic characteristics (54).

The current study aims to fill this gap in knowledge about the role of FI in the lives of PLHIV in India, which has the third highest number of PLHIV in the world (44), by describing FI in a sample of PLHIV from Karnataka, South India. In addition, since prior studies have mainly been conducted in (semi-) rural populations in developing areas (2, 4, 7, 8) or at-risk-populations such as the homeless or injecting drug users in resource-rich countries (15, 17, 24), this study extends previous work by focusing on FI among more mainstream and mostly urban PLHIV in a resource-limited setting. These findings could be useful for similar populations in other urban setting in South Asia as well.

Our second objective was to examine the link between FI and mental health, independent of HIV stigma. Based on previous research, we expected FI to be related to a higher level of depressive symptoms, and reduced QOL, and that this association could potentially be stronger for women than men (23, 55, 56). Since several prior studies among PLHIV also found that women had higher levels of FI (14, 57, 58) and depressive symptoms (23, 59), and lower QOL than men (40, 60), we chose to analyze the results by gender.

Methods

Setting and Sample

Data for the current analyses are from a two-year longitudinal study on ART adherence and drug resistance among PLHIV in Bengaluru (formerly Bangalore), the capital city of Karnataka State (South India). Karnataka is one of six states with a high HIV prevalence, according to India's National AIDS Control Organization (NACO); it has an adult HIV prevalence of 0.63% (61). Participants were recruited between August 2007 and November 2009 from two hospitals that served most PLHIV in the region at that time. One was a public hospital (n = 283) and the other a private hospital, where patients received HIV-related care from either a private physician (n = 93), or an ART center operating as a public-private partnership and following NACO guidelines (n = 157). Both in the public hospital and the ART center at the private hospital, the most common ART regimens (lamivudine + stavudine or zidovudine + nevirapine or efavirenz) were available at no cost to patients with a CD4 count below 200 cells/mm^3. Eligibility criteria for the study were (1) age 18 years or older and (2) on ART for at least 1 month at study enrollment. The FI measure was added in January of 2010, and hence was available only for some respondents in their 18, 21, and/or 24 month follow-up interview. For the sake of simplicity, since we only used data from these last three data collection waves, they are referred to below as FI baseline, first and second follow-up, respectively. Given our plan to analyze by gender, one respondent who identified as neither male or female, but as third gender ('hijra'), was excluded, resulting in a final sample of n=372 for the present analyses.

Procedures

Potential participants were referred to the study by clinic staff or by screening staff at outpatient clinic registration. In a private room, a trained interviewer assessed eligibility, explained the study, and obtained written informed consent from interested participants. The interviewer then administered a face-to-face interview that lasted approximately one hour and included demographics, health history, ART regimen and adherence, HIV stigma and other psychosocial factors. The questionnaire was developed in English, translated into Kannada, Tamil and Telugu, and independently back-translated into English. Participants were interviewed every three months for 24 months, with the FI measure included in the final three assessment waves. To limit respondent burden, the full set of questions was asked every six months, while the assessments in between did not contain the HIV stigma scales. At every full assessment, blood was drawn also for CD4 cell count, HIV plasma viral load measurement, and HIV genotypic resistance testing. More details can be found in Shet et al. (62). The study protocol was approved by the institutional review boards of the University of California, San Francisco; St John's National Academy of Health Sciences, Bengaluru; and the Indian Council of Medical Research.

Measures

The following measures were used in this study. All reliabilities reported are Cronbach's α from the current sample, at FI baseline.

Food insecurity was measured with the Household Food Insecurity Access Scale (HFIAS) (63), which has been widely used around the world (e.g., 58, 64–66). The HFIAS measures how often in the past month (1) the respondent worried about having enough food for the household (one item), (2) the respondent's household was not able to eat qualitatively desirable foods (three items), and (3) the respondent's household did not have sufficient quantities of food (five items) due to lack of resources. Response options range from 0 "no"/"never" to 3 "more than ten times." Scoring guidelines classify respondents as food secure, or mildly, moderately or severely food insecure (63). Reliability for this scale in our sample was very good: Cronbach's $\alpha = 0.94$.

Depression was measured via the Beck Depression Inventory, version I (BDI) (67), previously validated in South India (68). Responses to 21 items are added to create a variable with a range from 0 to 62, with higher scores indicating more (or more severe) depressive symptoms. Reliability was Cronbach's $\alpha = 0.90$.

Quality of Life was measured with 11 items from the short form of the Quality of Life Enjoyment and Satisfaction Questionnaire (69). On a scale from 0 "very unsatisfied" to 3 "very satisfied", participants indicated their satisfaction with their health, mood, finances, etc. during the past week. An overall score was created as the mean of all items. Cronbach's α was 0.93.

HIV stigma—Various types of HIV stigma were assessed via measures described in previous work (70). In each measure, 10 or 11 forms of discrimination or stigmatization of PLHIV were listed (e.g., PLHIV being forced to move out of their home, HIV as punishment for sins or karma). In the *felt stigma* measure (Cronbach $\alpha = 0.92$) participants were asked for each item how many people (0 "no one" to 3 "most people") in their community they perceived as holding this stigmatizing view. In the *internalized stigma* measure (Cronbach $\alpha = 0.86$) respondents indicated how strongly (0 "not at all" to 3 "a great deal") they believed that they deserved to be treated in a stigmatizing manner because of their HIV infection. For the *enacted stigma* measure (Cronbach's $\alpha = 0.84$) participants indicated whether or not they had experienced particular forms of stigmatization themselves, while in the *vicarious stigma* scale (Cronbach's $\alpha = 0.92$) participants were asked how often (0 "never" to 3 "frequently") they had heard about these enacted stigma events happening to other PLHIV. For the enacted stigma measure, affirmative responses were summed into a total index score. For felt, internalized and vicarious stigma, an overall scale score was calculated as the mean response over all items.

Disclosure avoidance was measured as the mean response on a 0 "never" to 3 "often" scale to 15 items listing various strategies PLHIV might adopt to avoid disclosure of their HIV status (e.g., describing their illness as tuberculosis, seeking health care outside of their community). Reliability was $\alpha = 0.74$.

HIV and ART related variables included number of side effects (out of 22) experienced in the past three months, start date and cost of ART. Viral load (VL) was measured by an in-house real time polymerase chain reaction with TAQMAN assay at Molecular Diagnostics

and Genetics, Reliance Life Sciences, Mumbai, India, and undetectable VL was defined as a plasma VL below 100 copies/ml.

Demographics included gender, age, marital status, number of children, place of residence, education, personal income, and religion.

Analyses

Descriptive analyses consisted of frequencies and percentages for categorical variables, and the mean and standard deviation for continuous variables. Comparisons between men and women were done via χ^2-test and *t*-test, respectively. Results reported are from FI baseline. Both follow-up waves showed comparable results.

The association between FI (independent variable) and depressive symptoms/QOL (dependent variables) while controlling for potential covariates was assessed via multiple linear regression. Given its distribution, FI was dichotomized as moderate or severe FI vs. mild or no FI. Conceptually, this cut-off separates respondents with at most occasional quality-related limitations from those forced to eat a limited variety or undesirable foods at least sometimes, or whose food quantity was ever compromised in the past four weeks. The BDI depression variable was first transformed by taking the natural logarithm (ln) of the original value + 0.1 (to eliminate scores of 0), to improve normality of its distribution (71). After regression, the resulting coefficients were exponentiated to reverse the ln-transformation. This exponentiation allows interpretation of the results in terms of percent change of BDI score in its original metric. The QOL variable's distribution did not require transformation.

To take full advantage of all available data from the cohort, we used data from the FI baseline and the second follow-up, six months later, in the regression analyses. The first follow-up was not included because it did not have stigma data. The interdependence between the repeated measurements within the same individuals was handled by using Generalized Estimating Equations (GEE), with robust standard errors. In addition to controlling for HIV stigma, variables that were considered as potential covariates were side effects and socio-demographics. Any of these variables that were bivariately associated with the outcome at $p<.20$, were included in subsequent multivariate analyses.

Results

Socio-demographic and HIV-related characteristics

Demographic and HIV-related information for the sample is presented in Table I. Thirty-five percent of respondents were female. Their mean age was 35 years, while for male participants it was 40 ($p<0.001$). At least 45% of both genders had ten or more years of education. The majority of respondents in both groups were married, but the subgroup of females also contained 46% formerly married respondents, mostly widows, compared to 7% for men ($p<0.001$). Most respondents in both groups had children, were employed and of Hindu religion. Apart from mean number of side effects −2.8 for women and 1.8 for men ($p=0.003$) – there were no gender differences on the HIV-related variables. By the time collection of FI data started, respondents had been on ART for an average of nearly 3 years,

and nearly all were receiving their anti-retroviral drugs for free from the government. Eighty-five percent had an undetectable VL.

Food insecurity

Table II shows the levels of FI observed at all three waves, by gender. At the FI baseline, over 80% of men and women were categorized as food secure. Food insecure men tended to fall mostly in the mild FI category (7% of total) while food insecure women mostly reported severe FI (11% of total). About 5% in each group was moderately FI (overall p=0.01). Results for the two follow-ups were similar, but showed a small shift in proportions for men from mild to severe FI, and for women in the opposite direction, and the overall χ^2 tests were no longer significant. Over the whole six-month follow-up period, 26% of women and 19% of men reported moderate or severe FI during at least one assessment (p=0.11, not shown in table).

Depressive symptoms, QOL and HIV stigma

At the FI baseline interview, women had a significantly higher mean BDI depression score than men (5.7 vs. 3.3, resp., p=0.01) and a significantly lower mean QOL score (2.0 vs. 2.1 resp., p=0.01) (Table III). Women perceived stigmatizing community norms to be higher than men (felt stigma mean 2.0 vs. 1.8, resp., p=0.03) while men reported higher mean levels of internalized stigma (0.5 vs. 0.3, p<0.001). There were no significant gender differences for enacted stigma (overall mean=0.5), vicarious stigma (overall mean=0.8) or disclosure avoidance (overall mean=0.7).

Association of depressive symptoms with food insecurity

Table IV shows the exponentiated regression coefficients from the bivariate and multivariate linear regressions of the ln-transformed BDI scores on FI, HIV stigma and other covariates. The exponentiation allows interpretation of the results in terms of percent change in BDI score. For men, FI was significantly associated with depressive symptoms, even after adjusting for HIV stigma and other covariates. Moderately to severely food insecure men had depression scores that were twice as high as more food secure men (exp(B)=2.00, p=0.003). All HIV stigma related variables showed significant unadjusted coefficients, but in the multivariate analyses, only internalized (exp(B)=2.76, p<0.001) and enacted stigma (exp(B)=1.13, p=.004) remained significantly positively associated with depressive symptoms. Both ART-related covariates were significantly associated with BDI scores as well: each additional side effect was related to a 23% increase in BDI score (exp(B)=1.23, p<0.001), and each additional month on ART with a 1% decrease (exp(B)=0.99, p=0.01). Income earning men had about two-thirds the number of depressive symptoms of men without income (exp(B)=0.64, p=0.04), and men with ≥10 years of education showed 43% higher BDI scores than less educated men (p=0.02), controlling for the other covariates.

In contrast with men, women's FI status was not significantly associated with their BDI score. The only stigma variable significantly associated with depressive symptoms in women was internalized stigma (exp(B)=2.26, p=0.004). ART side effects were associated with a 23% increase in BDI score (p<0.001), just like for men. Multivariate results for the demographic covariates, showed that, on average, married women had less than half the BDI

scores of unmarried women (exp(B)=0.46, p=0.002), and Hindu women twice the BDI scores of those of other religions (exp(B)=2.09, p=0.046).

Association of quality of life with food insecurity

Table V shows the results of the bivariate and multivariate linear regression analyses for the QOL outcome. On average, moderately to severely food insecure men had a 0.12 point lower QOL score (p=0.04) than more food secure men, when controlling for stigma and other covariates. All HIV stigma related variables were significantly related to QOL bivariately, but only the adjusted coefficient for disclosure avoidance was still significant in the multivariate regression: higher levels of disclosure avoidance in men were related to lower QOL (B=−0.12, p=0.004). Side effects were significantly negatively related to QOL (B=−0.05, p<0.001) and mean QOL was 0.18 points higher for men with income than for men without (p<0.001), again after controlling for other covariates.

Women's QOL was significantly related to FI as well. After adjustment, women with moderate to severe FI had a 0.21 point lower mean QOL score than more food secure women (p<0.001). Internalized and vicarious stigma were the only stigma variables included in the multivariate regression of QOL, based on the bivariate results, and only the adjusted coefficient of vicarious stigma was significant, indicating that women reporting higher vicarious stigma had higher mean QOL scores (B=0.08, p=0.01). A higher mean level of side effects was related to lower QOL in women (B=−0.04, p<0.001), and the only demographic variable that remained significant in the multivariate regression was marital status: married women showed a 0.10 point higher QOL score, on average, than unmarried women (p=0.01).

Discussion

This study is the first to document household food insecurity among a broad sample of PLHIV in India, and, to our knowledge, in resource-limited settings in Asia in general. We found that about a fifth of respondents experienced moderate or severe FI during the six-month period of data collection and that FI was linked to reduced psychological well-being, especially among men. The level of FI we observed was lower than figures from sub-Saharan Africa (2–10). This could be due to several factors, such as the fact that these PLHIV were mostly from an urban area and purchase, rather than grow, most of their food and hence were less immediately affected by drought, pests, etc. than subsistence farming PLHIV in rural sub-Saharan Africa. Over three quarters of respondents were earning an income, and this probably allowed most of them to generally provide at least quantities of food perceived to be sufficient for their families (as is implied in the HFIAS categories of food security and mild FI). The high level of employment was likely at least in part due to the fact that the PLHIV in our sample had been on ART for on average nearly 3 years, and none less than 1.5 years, and most had their HIV-infection under control and were well enough to work. In addition, during their time on ART, some may have learned how to access food or other aid, via information distributed at their ART clinic, NGO support groups for PLHIV, or our study office. At the time of data collection, some NGOs did provide food aid to some of its neediest members, and officially participants living below

the poverty line qualified for government-subsidized rations of food grains, but no data were available on participants' actual receiving of food aid. We found no sustained significant gender differences in FI rates. In the first of the three waves available, women were significantly more likely to report severe FI than men, but taking data from later waves and from more participants into account, this trend did not remain significant. Previous studies have reported mixed findings as well (13, 25, 57, 72).

This study demonstrated an association of FI with reduced psychological well-being, but found that the relationship differed for men and women. Moderate to severe FI was associated with lower QOL for both men and women, but FI's association with depressive symptoms was confirmed only for men. Previous research, by contrast, found that FI and depression were associated for women, but not men (23, 55, 56). None of these studies, however, were in India, and only Tsai et al.'s (23) was among PLHIV. A potential explanation for the results obtained in our study, is that by the time food security becomes compromised, one has made adjustments in other areas of life, resulting in a decrease in overall satisfaction with one's QOL, as was observed for both male and female participants in this study. The differential results for depressive symptoms make sense when considering that in Indian society men are expected to be the breadwinner, and hence FI could be considered a sign that they are failing in this important task that society imposes on them, and this could lead to their feeling depressed. Indian women, on the other hand, traditionally are charged with using the means available to secure enough and good food to feed the family, so when they have trouble achieving that, their QOL is affected, but not necessarily their level of depression because their self-esteem is not so much at stake since they are not expected to be the (main) breadwinner. Some of our other results are consistent with this 'traditional gender role' explanation as well. For men earning income was significantly related to a lower depression and higher QOL score, while for women the fact of being married was. Further, internalized stigma results showed that men were more likely than women to have internalized the shame of being HIV-positive, which could be another indication of men feeling they have failed their families, especially if they became infected through unprotected transactional sex, and subsequently infected their wife (73).

Mean levels of depressive symptoms were higher for the female than for the male PLHIV in our study. This finding is different from several small-scale studies with PLHIV in India, which found no significant gender differences (74–76), but it is consistent with results from large-scale studies on the general population of India (77–79). In our study, women had a lower overall QOL than men. Other studies among Indian PLHIV, using more detailed QOL instruments with several subscales, generally showed that women had a lower QOL in some, mostly psychological or feelings-related, domains but not others (40, 60, 80–82), which could result in an overall QOL difference as observed in our study.

Results regarding the link between HIV stigma and depression were mostly consistent with earlier work in South India (46, 48, 70), showing that enacted, and especially internalized stigma were significantly related to higher levels of depressive symptoms. QOL was not as strongly associated with HIV stigma as other studies in India have found (40, 49), possible due to different instruments for both stigma and QOL. We did find that men who went to greater lengths to avoid disclosure of their HIV infection had a lower QOL. For women, we

found, unexpectedly, that higher levels of vicarious stigma were associated with better QOL. Perhaps hearing more about stigmatization of other PLHIV made them feel more strongly that, comparatively, their own QOL is not so bad.

This study did have some limitations. One is the cross-sectional nature of the analyses, which prevents causal interpretation of the association between FI and psychological well-being. Though we did have cohort data, it was only three waves of FI data on part of the sample, and only two waves of stigma data. We decided cross-sectional analyses with a sufficient sample for gender-based analyses and inclusion of all covariates we deemed necessary, would allow us to draw more valid conclusions than time-lagged analyses on a smaller sample or without the stigma covariates. With regard to causality, we feel that the levels of depression observed generally were not so high that they would incapacitate a person to work, as was supported by the high proportion of respondents with employment, which makes it more likely that the depressive symptoms mostly were a consequence of FI rather than the other way around.

All data except VL was self-reported, which is susceptible to faulty memory and social desirability. The latter would likely lead to underreporting of both FI and the outcomes, given the shame attached both to mental health problems and FI. If respondents varied in degree of susceptibility to social desirability and consequent underreporting on these measures, it is possible that some of the apparent association between FI and mental health problems was due to this social desirability bias. Finally, while we recruited from hospitals that served most PLHIV in the area at that time to ensure representativeness of the sample, generalizability of our findings beyond South Indian PLHIV is not certain.

Conclusion

We found that most PLHIV in this South Indian sample of long-time ART users were food secure. PLHIV who did face moderate to severe food insecurity, reported lower QOL, as well as, for men at least, higher levels of depression than more food secure PLHIV. Interventions aimed at improving mental health of PLHIV have received increasing attention in recent years, both because depression is a known risk factor for suboptimal adherence to ART, and psychological well-being and QOL have become important goals onto themselves since ART has drastically increased survival rates and made HIV a manageable chronic health condition, even in more limited resource settings. Such interventions should consider incorporating nutritional supplementation to enhance food security among PLHIV given its potential synergistic benefits. Not only could the improved nutrition ameliorate HIV outcomes physically, a higher level of food security might also alleviate psychological distress and increase the quality of life of PLHIV. In India specifically, PLHIV suffering from FI will hopefully benefit from the National Food Security Act of 2013 (83) which expands the number of people entitled to subsidized food grains to about two-thirds of the population. On a more structural level, providing income-earning opportunities for PLHIV, particularly men, could have additional direct effects on psychological well-being, beyond their positive effect on food security.

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Table I

Demographic and HIV-Related Characteristics of Respondents at FI Baseline

Characteristic	All (n=372)		Men (n=243)		Women (n=129)		χ^2-value	p-value
	n	(%)	n	(%)	n	(%)		
Education:							11.95	0.02
None	40	(10.8)	17	(7.0)	23	(17.8)		
< 4 yrs	27	(7.3)	18	(7.4)	9	(7.0)		
4–9 yrs	109	(29.3)	70	(28.8)	39	(30.2)		
10 yrs	102	(27.4)	74	(30.5)	28	(21.7)		
> 10 yrs	94	(25.3)	64	(26.3)	30	(23.3)		
Employed/has income	288	(77.4)	216	(88.9)	72	(55.8)	52.73	<0.001
Marital status:							84.00	<0.001
Married	257	(69.1)	191	(78.6)	66	(51.2)		
Never married	40	(10.8)	36	(14.8)	4	(3.1)		
Formerly married	75	(20.2)	16	(6.6)	59	(45.7)		
Number of children:							1.29	0.73
0	81	(21.8)	54	(22.2)	27	(20.9)		
1	113	(30.4)	73	(30.0)	40	(31.0)		
2	124	(33.3)	84	(34.6)	40	(31.0)		
≥3	54	(14.5)	32	(13.2)	22	(17.1)		
Religion: Hindu	341	(91.7)	226	(93.0)	115	(89.1)	1.64	0.20
Free ART	358	(96.2)	233	(95.9)	125	(96.9)	0.24	0.78
Undetectable viral load[a]	308	(85.1)	205	(85.8)	103	(83.7)	0.26	0.61
	Mean	(SD)	Mean	(SD)	Mean	(SD)	*t*-value	p-value
Age, years	38.3	(8.5)	39.9	(8.2)	35.2	(8.2)	−5.31	<0.001
Months on ART	35.2	(13.5)	35.6	(13.2)	34.5	(14.0)	−0.74	0.46
No. of side effects (0–22)[a]	2.1	(2.8)	1.8	(2.5)	2.8	(3.3)	3.28	0.003

[a] n=239 males and 124 females due to missing data for 9 participants.

Table II

Food Insecurity Based on Household Food Insecurity Access Scale (HFIAS): n (%)

Food Insecurity (FI) Level	Baseline		First Follow-Up		Second Follow-Up	
	Men (n=156)	Women (n=92)	Men (n=193)	Women (n=110)	Men (n=239)	Women (n=128)
Food security	132 (84.6)	76 (82.6)	164 (85.0)	91 (82.7)	201 (84.1)	108 (84.4)
Mild FI	11 (7.1)	1 (1.1)	10 (5.2)	2 (1.8)	12 (5.0)	4 (3.1)
Moderate FI	9 (5.8)	5 (5.4)	11 (5.7)	6 (5.5)	16 (6.7)	6 (4.7)
Severe FI	4 (2.6)	10 (10.9)	8 (4.1)	11 (10.0)	10 (4.2)	10 (7.8)
χ^2 (p-value)	11.37 (0.01)		5.88 (0.12)		3.26 (0.35)	

Table III

Descriptives for Psychological Well-Being outcomes and HIV-Stigma: Mean (SD)

Variable (range)	All (n363) [a]	Men (n=239)	Women (n=124)	*t*-value	p-value
Depression:					
BDI index (0 – 62)	4.1 (6.9)	3.3 (5.0)	5.7 (9.4)	−3.21	0.01
ln BDI index (−2.3 – 4.1)	0.1 (2.0)	−0.1 (1.9)	0.5 (1.9)	2.89	0.004
Quality of Life (0 – 3)	2.0 (0.4)	2.1 (0.4)	2.0 (0.4)	2.67	0.01
Internalized stigma (0 – 3)	0.5 (0.6)	0.5 (0.7)	0.3 (0.5)	3.26	<0.001
Enacted stigma (0 – 11)	0.5 (1.5)	0.5 (1.4)	0.7 (1.6)	−1.24	0.22
Vicarious stigma (0 – 3)	0.8 (0.7)	0.7 (0.7)	0.8 (0.7)	−1.45	0.15
Felt stigma (0 – 3)	1.9 (0.7)	1.8 (0.7)	2.0 (0.7)	−2.13	0.03
Disclosure avoidance (0 – 3)	0.7 (0.5)	0.7 (0.4)	0.7 (0.5)	−0.40	0.69

Abbreviations: BDI, Beck's Depression Inventory; ln, natural logarithm

[a] Missing data for 9 participants.

Table IV

Unadjusted and Adjusted Exponentiated Linear Regression Coefficients for Depressive Symptoms, by Gender

Covariates	Men				Women			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	Exp(B) (SE)	p	Exp(B) (SE)	p	Exp(B) (SE)	p	Exp(B) (SE)	p
Moderate-severe FI	2.96 (0.92)	<0.001	2.00 (0.47)	0.003	1.66 (0.62)	0.17	1.30 (0.42)	0.41
Internalized stigma	3.67 (0.47)	<0.001	2.76 (0.39)	<0.001	2.92 (0.86)	<0.001	2.26 (0.64)	0.004
Enacted stigma	1.31 (0.07)	<0.001	1.13 (0.05)	0.004	1.08 (0.11)	0.45		
Felt stigma	1.94 (0.25)	<0.001	1.23 (0.16)	0.12	1.24 (0.21)	0.21		
Vicarious stigma	1.85 (0.24)	<0.001	1.01 (0.13)	0.95	1.21 (0.18)	0.19	1.03 (0.14)	0.85
Disclosure avoidance	1.65 (0.33)	0.01	0.92 (0.16)	0.62	1.11 (0.27)	0.67		
No. of side effects	1.34 (0.04)	<0.001	1.23 (0.04)	<0.001	1.29 (0.04)	<0.001	1.23 (0.04)	<0.001
No. of months ART	0.99 (0.01)	0.15	0.99 (0.01)	0.01	0.99 (0.01)	0.35		
Has income	0.45 (0.14)	0.01	0.64 (0.14)	0.04	1.50(0.39)	0.13	0.94 (0.23)	0.82
Married	0.42 (0.12)	0.002	0.68 (0.14)	0.06	0.41 (0.11)	0.001	0.46 (0.11)	0.002
Age, years	1.01 (0.01)	0.67			1.03 (0.02)	0.08	1.01 (0.01)	0.61
≥ 10 yrs education	1.40 (0.31)	0.13	1.43 (0.22)	0.02	0.54 (0.16)	0.03	1.02 (0.01)	0.95
Hindu	2.43 (0.98)	0.03	1.65 (0.48)	0.09	3.73 (1.47)	0.001	2.09 (0.77)	0.046
Time[a]	0.86 (0.14)	0.36			1.03 (0.21)	0.87		

NOTE: BDI depression score was ln-transformed before linear regression. To return to the original metric, regression coefficients were exponentiated.

Abbreviations: Exp(B), exponentiated regression coefficient; SE, robust standard error

[a] FI baseline = 0, 2nd follow-up = 1

Table V

Unadjusted and Adjusted Linear Regression Coefficients for Quality Of Life, by Gender

Covariates	Men				Women			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	B (SE)	p	B (SE)	p	B (SE)	p	B (SE)	p
Moderate-severe FI	−0.23 (0.07)	0.001	−0.12 (0.06)	0.04	−0.23 (0.07)	0.001	−0.21 (0.05)	<0.001
Internalized stigma	−0.10 (0.03)	0.001	−0.02(0.03)	0.35	−0.14 (0.05)	0.01	−0.05(0.04)	0.16
Enacted stigma	−0.04 (0.01)	0.01	−0.003 (0.01)	0.78	−0.01 (0.01)	0.70		
Felt stigma	−0.08 (0.03)	0.001	−0.01 (0.03)	0.71	−0.01 (0.04)	0.71		
Vicarious stigma	−0.10 (0.03)	<0.001	−0.03 (0.03)	0.25	0.04 (0.03)	0.17	0.08 (0.03)	0.01
Disclosure avoidance	−0.16 (0.04)	<0.001	−0.12 (0.04)	0.004	−0.02 (0.04)	0.60		
No. of side effects	−0.06 (0.01)	<0.001	−0.05 (0.01)	<0.001	−0.05 (0.01)	<0.001	−0.04 (0.01)	<0.001
No. of months ART	−0.001 (.002)	0.48			0.001 (.002)	0.55		
Has income	0.22 (0.07)	0.001	0.18 (0.05)	<0.001	0.001 (0.05)	0.99		
Married	0.09 (0.05)	0.08	0.02 (0.04)	0.61	0.13 (0.05)	0.02	0.10 (0.04)	0.01
Age, years	−0.003 (.003)	0.30			−0.01 (.002)	0.045	−0.001 (.002)	0.64
≥ 10 yrs educ	0.02 (0.04)	0.68			0.11 (0.05)	0.03	0.01 (0.05)	0.88
Hindu	0.05 (0.08)	0.53			−0.15 (0.07)	0.03	−0.03 (0.08)	0.70
Time[a]	−0.07 (0.03)	0.04	−0.07 (0.03)	0.04	−0.06 (0.04)	0.13	−0.06 (0.04)	0.11

Abbreviations: B, regression coefficient; SE, robust standard error

[a] FI baseline = 0, 2nd follow-up = 1