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Food insecurity, internalized stigma, and depressive symptoms among women living with HIV in the United States

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Abstract

Food insecurity, internalized HIV stigma, and depressive symptoms are independently associated with poor HIV outcomes. Food insecurity, stigma, and depression may be interrelated among women living with HIV (WLHIV). We hypothesized that food insecurity would be independently associated with internalized stigma and depressive symptoms among WLHIV in the United States (US), and would partially account for associations between stigma and depressive symptoms. We tested hypotheses using regression models and partial correlation analysis with cross-sectional data among 1,317 WLHIV from the Women's Interagency HIV Study. In adjusted models, greater food insecurity was associated with internalized HIV stigma and depressive symptoms (all $p<0.05$), exhibiting dose-response relationships. Food insecurity accounted for 23.2% of the total shared variance between depressive symptoms and internalized stigma. Food insecurity is associated with depressive symptoms and internalized HIV stigma among US WLHIV, and may play a role in the negative cycle of depression and internalized stigma.

Keywords

food insecurity; internalized stigma; women; United States; depression; HIV

INTRODUCTION

Internalized HIV stigma and depression are highly prevalent and interlinked psychological phenomena that can undermine health outcomes for people with HIV [1–5]. Stigma is a social process that systematically discredits people possessing an attribute, or attributes, devalued by the dominant power structure [6,7]. Enacted stigma is the actual experience of prejudice and discrimination based on HIV status, while internalized stigma is the internal endorsement of the external, social process of HIV stigma [8–11]. Stigma is reinforced by existing inequalities of class, race, gender and sexuality [6], with further multiplicative effects that reproduce social difference and inequality [6,12]. Women living with HIV (WLHIV) report higher levels of negative self-image related to HIV[13], and greater fear or anticipation of HIV-related discrimination and rejection [14] compared to men. Previous research suggests depressive symptoms may be increased in people who experience internalized HIV stigma [15–17]. Recent work from the Women's Interagency HIV Study (WIHS) found that depressive symptoms mediated the relationship between internalized stigma and poor adherence to ART among women in the United States (US) with HIV [18].

Identifying modifiable contextual factors that may foment HIV stigma, and that may play part of the cycle of stigma production and reinforcement, is critical to developing comprehensive approaches to reducing stigma and depression among vulnerable populations living with HIV. One of these modifiable factors may be food insecurity, defined as having limited or uncertain availability of nutritionally adequate, safe foods, or the inability to acquire personally acceptable foods in socially acceptable ways [19]. Food insecurity affects up to half of all people living with HIV in resource-rich settings [20,21]. Food insecurity is intimately connected to poverty but should not be understood as a simple proxy for financial

deprivation: although food insecurity risk rises as household incomes decrease, not everyone who is poor is food insecure [22]. Within a context of economic scarcity, social factors can play an important role in determining household food insecurity, including levels of social support [23] and/or social isolation [24], as well as access to community resources [25]. Research consistently demonstrates that food insecurity is independently associated with poor health outcomes among people living with HIV even after adjusting for measures of socioeconomic status (i.e. income and education), including decreased medication adherence [1,26], poorer immunologic and virologic outcomes [27,28], and increased HIV related morbidity and mortality [29,30].

Food insecurity is a source of significant distress [31] and shame [32–35], particularly for women [36]. While limited research has examined the direct association between food insecurity and HIV stigma, literature on intersectional stigma and social support suggest a relationship between food insecurity and stigma. Intersectional stigma theory posits that stigma from multiple aspects of life (e.g., racism, sexism, classism) interact with, and amplify, HIV stigma [37–39]. For example, stigma related to poverty and food insecurity [32–35,40] has been linked to negative psychosocial outcomes [32] and could contribute to internalized HIV stigma. Conversely, internalized stigma may lead to food insecurity if it causes or intensifies isolation from social support systems [23]. Research in Uganda has linked food insecurity and internalized HIV stigma [23], but no studies in the US or other resource-rich settings – where differing social and economic contexts may generate different findings – have examined this relationship. The relationship between food insecurity and depression has been better documented in the scientific literature, particularly in the general population [41–44], although gaps remain. In particular, to our knowledge there are no estimates of the association between food insecurity and depressive symptoms among WLHIV in the US or other high-income countries. Yet, studies have documented associations between food insecurity and depressive symptoms in HIV study populations comprised primarily of men [45,46].

We examined associations between food insecurity, internalized stigma, and depressive symptoms, using cross-sectional data from a national cohort of WLHIV in the US. We hypothesized that food insecurity would be independently associated with greater internalized HIV stigma and greater depressive symptom severity. Further, given documented associations between internalized HIV stigma and depression in the scientific literature, we hypothesized that food insecurity would partially explain the association between internalized HIV stigma and depressive symptoms.

METHODS

Data and population

This cross-sectional analysis used data from the Food Insecurity sub-Study (FIS) of the WIHS. WIHS is an ongoing, multi-site prospective study established in 1994 to investigate the impact of HIV among women in the U.S, and includes both HIV sero-positive and HIV sero-negative women [47,48]. Collection of biological, clinical, demographic, and behavioral data is conducted in 9 WIHS sites (Bronx, NY; Brooklyn, NY; Washington, D.C.; Chicago, IL; San Francisco, CA; Chapel Hill, NC; Miami, FL; Birmingham, AL/Jackson, MS; Atlanta, GA – see Supplemental Table 1 for breakdown of study participants by site) via

biannual interviews, physical exams, and laboratory tests. Starting in 2013, the FIS collected annual data on food security and internalized stigma among all WIHS women. The current analysis is based on data from the baseline FIS visit (April 2013 to March 2014) for all WLHIV from all nine WIHS sites. Participants provide written informed consent and are compensated for participation. This study was approved by the Institutional Review Board at each study site's institution and by the WIHS Executive Committee.

Measures

Outcome variables—Our primary outcomes were internalized HIV-related stigma and depressive symptom severity. We measured internalized HIV stigma using a brief 7-item version of the negative self-image sub-scale adapted by Bunn et al [49] from Berger and colleague's HIV Stigma Scale [50]. Scale items included statements such as "Having HIV/AIDS makes me feel that I'm a bad person" and "I feel guilty because I have HIV/AIDS", and also included one reverse coded item: "I never feel ashamed of having HIV/AIDS". Scores range from 1 to 4, with higher scores indicating worse internalized stigma. Cronbach's alpha for the internalized stigma scale was 0.896, indicating good internal consistency.

Depressive symptom severity was assessed every six months using the 20-item Center for Epidemiologic Studies Depression (CESD) scale[51]. The CESD assesses how often over the past week the respondent experienced symptoms associated with depression, such as restless sleep, feeling down, and feeling lonely. Scores can range from 0 to 60, with higher scores indicating greater depressive symptoms. Cronbach's alpha for the CESD in our sample was 0.912, indicating high internal consistency. We used the standard cut-off of CESD score ≥ 16 to create a binary variable for probable depression [52]. For use in sensitivity analysis, we also created a modified 16-item version of the CESD excluding physical symptoms (such as poor appetite and tiredness/fatigue) that may overlap with HIV illness symptoms [53] and food insecurity.

Explanatory variable—Food security was assessed using the 18-item United States Department of Agriculture (USDA) Household Food Security Survey Module (HFSSM), a validated scale [54] considered to be the reference measure of population food security in the US [55]. The scale – supported by ethnographic work among women and other vulnerable population [31,56,57] – captures uncertainty about food supplies, insufficient diet quality, and insufficient food quantity over the previous 12 months. Items refer to all household members, including separate items for adults and children. HFSSM categorizes individuals as having high food security, marginal food security (i.e. some uncertainty about food supplies, but little to no indications of change in diet or food intake), low food security (i.e. reduced quality, variety, or desirability of diet, but little or no indication of reduced food intake) or very low food security (i.e. multiple indications of disrupted eating patterns and reduced food intake). Cronbach's alpha for the HFSSM was 0.882, indicating high internal consistency.

Potential confounders—Based on our previous research and the literature[45,46,58], we considered the following variables as potential confounders: age in years (continuous), race/

ethnicity (non-Hispanic white [reference]), non-Hispanic black, Hispanic or other), no high school education or equivalent (vs. has a high school degree or equivalent), annual income categories as collected in WIHS ($6000 or less [reference], $6001–$12000, $12001–$18000, $18001–$24000, $24001–$30000, $30001–$36000, $36001–$75000, > $75000), has child dependents (vs. none), CD4 nadir (continuous), and drug use, defined as self-reported cocaine, crack, heroin, methamphetamine, hallucinogens, club drugs, non-prescribed narcotics, or any other illicit recreational drugs since last visit (vs. none).

Analysis

We aimed to assess the independent association of food insecurity with internalized HIV stigma and depressive symptom severity, and to determine if food insecurity partially explained the correlation between our two primary psychosocial outcomes. All analyses were conducted using Stata 13 (College Station, TX: StataCorp LP), and we present all numerical results to three significant digits.

To understand the independent association of food insecurity with psychosocial outcomes, we used multivariable linear regression to model the association between food insecurity and each of the outcomes separately (internalized HIV stigma and depressive symptom severity), adjusting for potential confounders (age, race/ethnicity, education, income, child dependent status, CD4 nadir, and illicit drug use). Regressions were modeled using full-information maximum likelihood (FIML) which allows the use of all observations, even those with some missing values of covariates, under the assumption of missing at random. Using FIML, we retained 275 observations in the regression of internalized stigma score on food insecurity and 271 observations in the regression of depressive symptom score on food insecurity that would have been lost in a complete-case analysis. The multivariable linear regressions with FIML were implemented in Stata using the *sem* command. We tested for linear trend in dose-response relationships between food insecurity and each outcome by regressing the outcome on food insecurity treated as an ordinal numerical variable. For the secondary analysis of the association between probable depression and food insecurity, we used logistic regression adjusting for the same potential confounders as the linear regressions. This was a complete-case analysis as FIML estimation was not available for logistic regression in Stata; a comparison of sample characteristics between women included and excluded in the complete case analysis are provided in Supplemental Table 2. Results were interpreted as statistically significant at $\alpha < 0.05$.

As robustness checks, we 1) re-estimated our linear models using complete-case multivariable linear regression and compared the results to those obtained using FIML, and 2) re-estimated our main analyses using the modified 16-item CESD scale that excluded physical symptoms; no substantive differences were seen with either robustness check. Given that the distributions of CESD and internalized stigma were positively skew we ran a final robustness check using ordinal logistic models where the outcomes were made into quartiles, and found similar magnitude and significance of associations.

We then implemented a partial correlation analysis to examine the extent to which food insecurity explains the association between internalized HIV stigma and depressive symptom severity [59]. Partial correlation analysis assesses the relationship between two

variables without specifying the direction of the relationship, while holding constant other variables [60]. This method was appropriate to examine the role of food insecurity in the association of depressive symptoms and internalized stigma given sparse literature to inform hypotheses regarding the direction and form of the relationships. First, we calculated the unadjusted correlation between depressive symptoms and internalized stigma (A). We then calculated their correlation adjusted for potential confounders examined in our regression analyses [income, age at visit, race/ethnicity, educational level, child dependents, CD4 nadir, and illicit drug use], *not including* food insecurity (B). Finally, we calculated their correlation adjusted for potential confounders *including* food insecurity (C). We calculated the proportion of variance between depressive symptoms and internalized stigma as the square of the correlation between depressive symptoms and internalized stigma for models A, B, and C. To assess the extent to which food insecurity explained the proportion of shared variance between depressive symptoms and internalized stigma, we took the difference in the proportion of variance between the adjusted models (B–C). We then divided this difference by the proportion of variance in the 1) unadjusted model (A) to estimate the proportion of *total* shared variance accounted by food insecurity, and 2) adjusted model (B) to capture the proportion of *unexplained* shared variance accounted for by food insecurity.

RESULTS

Among the 1,317 women who completed WIHS interviews in our study period, 1,305 women with HIV had data on the primary explanatory variable (food insecurity), 1,305 had data on depressive symptoms, and 1,242 had data on internalized stigma. Thus 1305 and 1242 women were included in our main analyses on depressive symptoms and internalized stigma, respectively; 1238 women had data on both depressive symptoms and internalized stigma and were included in the partial correlation analysis. Women with missing data on one of the key variables above were not systematically different in age, race/ethnicity, education, income, illicit substance use, child dependent status, or with any of the outcome variables compared to women included in the analysis.

In our analytic sample, mean age was 48.7 years and the majority of women identified as African American non-Hispanic (68.8%) (Table 1). An additional 16.2% identified as Hispanic and 11.6% as non-Hispanic white. About one-third of women had less than a high-school degree (33.8%) and over half (53.1%) had average annual household incomes under $12,000. Thirty-five percent of participants reported having child dependents under age 18. About one in ten women reported using illicit drugs since the last study visit (9.8%).

Participants had a mean depressive symptom severity score of 12.30 [standard deviation (SD)=11.32) (Table 1). Almost one-third (32.6%) met the threshold for probable depression. The mean internalized stigma score was 1.76 (SD=0.627). Food insecurity affected 41.6% of study participants: 15.7% had marginal food security, 13.4% had low food security, and 12.5% had very low food security.

In adjusted analyses (n=1,242), greater severity of food insecurity was associated with higher internalized stigma scores, exhibiting a dose-response relationship (Table 2). Marginal, low, and very low food security were associated with 0.106 (standard error

(SE)=0.0487, p=0.03), 0.217 (SE=0.0524, p<0.001), and 0.493 (SE=0.0542, p<0.001) higher internalized stigma scores, respectively, compared to high food security. The test for trend for the dose-response relationship between food insecurity and internalized stigma score was statistically significant (p<0.001). We observed a similar dose-response relationship in the association between food insecurity and depressive symptom severity (n=1,305), whereby marginal, low, and very low food insecurity were associated with 4.08 (SE=0.827), 5.81 (SE=0.893), and 9.01 (SE=0.914) greater depressive symptom severity (all p<0.001), respectively, compared to high food security. The test for trend for the dose-response relationship between food insecurity and depressive symptom severity was statistically significant (p<0.001).

When examining results on the dichotomous outcome of probable depression (n=1,148), marginal, low, and very low food security were associated with 2.36 [95% confidence interval (CI) 1.63, 3.42], 3.18 [95% CI 2.14, 7.73], and 4.19 [95% CI 2.79, 6.30] higher odds of probable depression (all p<0.001), respectively, compared to high food security (dichotomous results not shown in table). The characteristics of women included in the complete case analysis of probable depression were not statistically significantly different from the characteristics of women excluded from this analysis (see Supplemental Table 2).

Having child dependents and higher age were associated with lower internalized stigma scores (Table 2). Having less than a high school degree and reporting illicit drug use was associated with higher depressive symptom severity. Reporting $18,000 in annual income or more was associated with lower depressive symptom severity compared to those with annual incomes of $6000 or less; higher age and having child dependents were also associated with lower depressive symptom severity.

The unadjusted correlation between depressive symptom severity and internalized stigma was 0.377, indicating that internalized stigma explained 14.2% of the variance in depressive symptom severity and vice versa (Table 3). When we adjusted for potential confounders but not food insecurity, this correlation was 0.363 and proportion of variance explained between internalized stigma and depressive symptoms was 13.1%. Adjusting for food insecurity in addition decreased the correlation between internalized stigma and depressive symptoms to0.3013, indicating that internalized stigma explained 9.8% of the variance in depressive symptom severity and vice versa. The change in the proportion of variance explained between internalized stigma and depressive symptoms when food insecurity was added to other potential confounders was 3.3%. Therefore, food insecurity accounted for 23.2% (i.e., 3.3/14.2) of the total shared variance and 25.2% (i.e. 3.3/13.1) of the unexplained shared variance between internalized stigma and depressive symptoms adjusted for confounders.

DISCUSSION

Increasing severity of food insecurity was independently associated with higher internalized HIV stigma and increased depressive symptom severity among WLHIV in the United States, exhibiting a dose-response relationship. Furthermore, food insecurity accounted for about one-fifth of the shared variance between internalized stigma and depressive symptoms, above and beyond other measures of socioeconomic status. The interrelationships we

observed between food insecurity, internalized HIV stigma, and depressive symptoms underscore the relationship between psychosocial wellbeing and the conditions in which WLHIV live, in the United States and elsewhere.

Women with HIV in the US – the majority of whom are women of color and lower income – live with multiple marginalized identities (including along lines of race, class, gender) [61–63] that may converge to create significant stress [37,64] and lead to daily resource restrictions, including food insecurity. In this context, there are multiple reasons we may have observed an association between food insecurity and internalized HIV stigma among WLHIV. Shame and felt stigma associated with poverty and food insecurity are common and may increase vulnerability to internalized HIV stigma by creating or intensifying negative affect, including poor self-concept. For example, using food banks has been associated with perceived stigma among women with children [32–35]. The concept that stigma from one aspect of life, such as race, gender, employment, or income, can exacerbate internalized HIV stigma is generally referred to as "intersectional stigma" [37–39], Intersectional stigma may be particularly relevant to understand the experience of WLHIV in the US, who are disproportionately African American and Latina [65] and therefore likely to have encountered racism, sexism, and related forms of discrimination in addition to HIV-related stigma. Multiple studies investigating this concept have shown that stigma from racism, sexism, sexual identity, and engagement in sex work converge with HIV-related stigma and can exacerbate poor health outcomes [6,37,66–68]. For instance, food insecurity is associated with risky sex (e.g., transactional sex, unprotected sex) and drug use. Risky sex and drug use in turn not only increase the risk of acquiring and transmitting HIV [69–72] but are also associated with their own social stigmas that intertwine with racism and sexism [37,65,66]. If risky behaviors linked to food insecurity were perceived as the reason for HIV acquisition, food-insecure women may have experienced, and consequently internalized, greater blame for their HIV status [37], which could lead to internalized HIV stigma as well as depression [15]. Considering the reverse directionality, internalized stigma may worsen food insecurity if it leads to the isolation of WLHIV from family or community resources that could provide a critical safety net in times of need [23].

Our finding of a strong dose-response relationship between food insecurity and depressive symptoms among WLHIV extends previous literature in several important ways. General population studies have found that food insecurity is a significant source of emotional distress and is associated with depression among women [31,41–44]. Studies among primarily male populations living with HIV have documented strong associations between food insecurity and depressive symptoms but only at very severe levels of food insecurity (i.e. hunger or severe food insecurity) [45,46]. Compared to men, WLHIV may be more vulnerable to depression arising from mild or moderate food insecurity given the role women tend to play in managing food resources for their households. Studies have documented that women will go to significant lengths to provide adequate food for their families, particularly children, including sacrificing their own physical and mental health [73]. Apart from this caregiving explanation, research on poverty also indicates that food insecurity can undermine social relationships and lead to feelings of low self-efficacy among women [74]. Food insecurity may thus trigger a particularly deep sense of helplessness among women, leading to mental and emotional distress [41,43,74].

The role of food insecurity in the relationship *between* internalized stigma and depressive symptoms (above and beyond separate associations with internalized stigma and depressive symptoms) is likely complex. The partial correlation analysis was undertaken to allow us to remain agnostic as to the direction of the association between internalized stigma and depressive symptoms, which we believe may be bidirectional. The analysis showed that food insecurity, beyond being separately associated with internalized stigma and depressive symptoms, accounted for about one-fifth of the shared variance between internalized stigma and depressive symptoms. Food insecurity may be implicated as a source of distress [31] that could both lead to, or result from, internalized HIV stigma and that may in turn lead to depressive symptoms [15–17]. Depressive symptoms resulting from internalized HIV stigma may further compromise one's ability to maintain self-sufficiency, for example due to loss of economic productivity or employment, and lead to or worsen food insecurity. Another possible explanation is that food insecurity may affect internalized stigma via depressive symptoms if these symptoms decrease women's access to social support including support for food, which in turn increases vulnerability to negative self-image related to HIV status [75,76]. Qualitative and longitudinal quantitative data are needed to elucidate the nuanced relationships between food insecurity, HIV stigma, and depressive symptoms.

Our study has several important strengths, including the large sample size, use of reliable and valid scales to assess outcomes and explanatory variables, and the representativeness by age and race of WLHIV in the US. The study has several limitations. First, the data are observational and cross-sectional and so we cannot ascertain directionality or causality. Second, although the regression models assumed uncorrelated errors, it is possible that women who tended to over-report (or under-report) food insecurity also over-reported (or under-reported) stigma and depressive symptoms, which could bias the results away from the null. Third, although the literature suggests intersectional stigma may play a role in the relationship between food insecurity and internalized HIV stigma, data on other forms of stigma (e.g., stigma related to poverty or food insecurity) were not collected in WIHS at the time of the study, and we were not able to directly examine the role of intersectional stigma. Future studies should investigate how stigma related to food insecurity may mediate the relationship with internalized HIV stigma. Fourth, results may not be generalizable to all WLHIV in the US if there are systematic differences among women living in geographic areas without a WIHS site, or selection bias related to the opportunity or decision to enroll in WIHS in areas with a recruitment site.

CONCLUSION

In conclusion, this study suggests a need to unpack and address the complex interplay between the lived experiences of deprivation and inequality, stigma, and depressive symptoms that undermine the health of WLHIV in order to optimize interventions in this population. A recent small pilot study found that providing comprehensive, medically appropriate food support to people living with HIV in the San Francisco Bay Area was associated with improved depressive symptoms over time; in the same study, a reduction in internalized stigma was also observed, but the difference was not statistically significant [77]. Large, rigorously designed longitudinal and intervention studies are needed to test causal relationships between food insecurity, stigma, and depression. Such understanding will be

critical for developing holistic and comprehensive approaches to improve the health of women with HIV.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE I

Sample characteristics (N=1317)

Sample characteristics	Variable *n*	Mean (SD) or %
Depressive symptoms score (CESD) [a], mean (SD)	1305	12.30 (11.32)
Probable depression (CESD≥16), %	1305	32.6
Internalized stigma score [b], mean (SD)	1242	1.76 (0.627)
Food security, %	1300	
High		59.0
Marginal		15.4
Low		13.2
Very low		12.5
Age in years, mean (SD)	1317	48.7 (8.70)
Race/ethnicity, %	1317	
White, non-Hispanic		11.6
African American, non-Hispanic		68.8
Hispanic		16.2
Other		3.3
Less than high school degree, %	1316	33.8
Annual household income, %	1264	
$6000 or less		14.3
$6001–$12000		38.8
$12001–$18000		12.8
$18001–$24000		7.6
$2401–$30000		5.6
$30001–$36000		5.1
$36001–$75000		9.8
> $7500		6.0
Has child dependents, %	1302	35.1
CD4 nadir, mean (SD)	1216	302.4 (209.2)
Illicit drug use, %	1310	9.8

Notes: N=1317 are all women with a study visit during baseline; the variable-specific “n” shows how many observations were available for each variable.

[a] Scores range from 0 to 60; higher scores indicate higher depressive symptom severity.

[b] Scores range from 1 to 4; higher scores indicate higher internalized stigma

TABLE II

Association of food security categories with internalized stigma and depressive symptom severity: adjusted coefficients for women with HIV

	Internalized stigma severity (n=1242)			Depressive symptoms severity (n=1305)		
	β	SE	p-value	β	SE	p-value
Food security						
High	Ref			Ref		
Marginal	0.106	0.0487	0.03	4.08	0.827	<0.001
Low	0.217	0.0524	<0.001	5.81	0.893	<0.001
Very low	0.493	0.0542	<0.001	9.00	0.914	<0.001
Age in years	−0.0990	0.0214	<0.001	−0.775	0.362	0.03
Race						
White, non-Hispanic	Ref			Ref		
African American, non-Hispanic	0.00901	0.0560	0.9	−1.86	0.938	0.05
Hispanic	−0.0140	0.0677	0.8	−2.27	1.13	0.05
Other	0.0464	0.107	0.7	−3.13	1.78	0.08
Less than high school degree	0.00977	0.0379	0.8	1.77	0.636	0.005
Income category						
$6000 or less	Ref			Ref		
$6001–$12000	−0.0229	0.0542	0.7	0.889	0.909	0.3
$12001–$18000	−0.0403	0.0676	0.6	−1.11	1.13	0.3
$18001–$24000	−0.107	0.0781	0.2	−3.67	1.30	0.005
$24001–$30000	−0.0638	0.0867	0.5	−3.28	1.46	0.02
$30001–$36000	−0.00766	0.0921	0.9	−1.69	1.50	0.3
$36001–$75000	−0.0593	0.0746	0.4	−3.84	1.24	0.002
> $75000	0.0380	0.0915	0.7	−4.48	1.48	0.003
Has child dependents	−0.0918	0.0389	0.02	−1.80	0.657	0.006
CD4 nadir	0.0000256	0.0000836	0.8	0.00135	0.00144	0.3
Illicit drug use	0.0973	0.0575	0.09	5.44	0.979	<0.001

Notes: Results presented in Table 2 obtained using multivariable linear regression with full-information maximum likelihood estimation.

Table III

Partial correlation analysis of food insecurity in the relationship between internalized HIV stigma and depressive symptom severity (n=1238)

	Correlation between depressive symptoms and internalized stigma (*r*)	**Proportion of variance explained (r^2 x 100)**
A) Unadjusted	0.377	14.2%
B) Adjusted for potential confounders[1] (model excluding food insecurity)	0.363	13.1%
C) Adjusted for potential confounders[1] (model including food insecurity)	0.313	9.8%
D) *Proportion of total shared variance (i.e. unadjusted) between depressive symptoms and internalized stigma accounted for by food insecurity*[2]		**23.2%**
E) *Proportion of unexplained shared variance (i.e. adjusted for potential confounders) between depressive symptoms and internalized stigma accounted for by food insecurity*[3]		**25.2%**

Notes: n=1238 is the sample of women who have data on both internalized stigma and depressive symptoms and were thus included in the partial correlation analysis.

[1] Potential confounders are equivalent to those in Table 2: age (continuous, years), race/ethnicity (categorical), less than high school diploma (dichotomous), income (categorical), has child dependents (dichotomous), CD4 nadir (continuous, cells/mm^3), and illicit drug use (dichotomous).

[2] D = [B-C/A] = [(13.1 – 9.8)/14.2].

[3] E = [(B-C)/B] = [(13.1 – 9.8)/13.1]