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Food Insecurity and Risky Sexual Behaviors Among Homeless and Marginally Housed HIV-Infected Individuals in San Francisco

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Abstract

Food insecurity is common among HIV-infected populations in resource-rich and resource-poor countries. We hypothesized that food insecurity would be associated with risky sexual behaviors. We examined this hypothesis among all sexually active participants ($n = 154$) in the Research on Access to Care in the Homeless (REACH) cohort in San Francisco. The outcomes were unprotected vaginal or anal sex and multiple sexual partners during the prior 90 days. Associations were examined using repeated measures multivariable logistic regression analyses. Food insecurity was independently associated with unprotected sexual activity (AOR = 2.01 for each five point increase in HFIAS scale, 95 % CI 1.31–3.10) and multiple sexual partners (AOR = 1.54 for each five-point increase in HFIAS scale, 95 % CI 1.05–2.29). Food insecurity is a risk factor for unprotected sexual activity and multiple sexual partners among homeless and marginally housed HIV-infected individuals in San Francisco. Measures to alleviate food insecurity may play a role in decreasing secondary HIV transmission.

Keywords

Food insecurity; HIV/AIDS; Sexual risk

Introduction

In the United States, HIV/AIDS affects the urban poor disproportionately [1]. Substance use, limited access to health services, overlapping sexual networks, and difficulties in meeting survival needs contribute to the spread of HIV [2–4]. Food insecurity is highly prevalent among vulnerable HIV-infected urban populations globally [5–8]. HIV and food insecurity are hypothesized to be linked in a cycle where the presence of one condition predisposes and contributes to worsening severity of the other condition [9, 10]. Among HIV-infected individuals, food insecurity is associated with worse health outcomes including poor physical and mental health [5, 11–13], suboptimal adherence to antiretroviral therapy [14–16], incomplete virologic suppression [14, 15, 17] and mortality [18]. Food insecurity remains, however, an under-studied potential contributor to risky sexual behavior.

Behavioral pathways link food insecurity and high-risk sexual behavior when people engage in high-risk sexual behavior as a means of negotiating other subsistence needs [9]. A growing body of literature, mainly from resource limited settings, suggests that food insecurity places individuals in highly constrained situations that increase the likelihood of unprotected sex and subsequent sexually transmitted infections including HIV. For example, large population-based study in Botswana and Swaziland found that food insufficiency was independently associated with inconsistent condom use with a non-primary partner, sex exchange, intergenerational sex, and lack of control in sexual relations [19]. In a qualitative study of individuals living with HIV/AIDS in Uganda, food insecurity decreased control over condom use and increased the risk of transactional sex [20]. A cross-sectional study among female sex workers in Lagos, Nigeria demonstrated poverty and lack of means to obtain food were common key contributors in the decision to join the sex trade and to engage in unprotected sex with clients [21]. To date, only a few studies have assessed linkages between food insecurity and risky sex in resource rich settings. Among HIV-infected injection drug users in Vancouver, Canada, severe food insecurity was associated with increased risk for recent unprotected sex [22]. In a national survey in Brazil of sexually active women, severe food insecurity with hunger was associated with reduced odds of consistent condom use and condom use at last sexual intercourse [23]. There are no previous studies on the relationship between food insecurity and high-risk sexual behavior among people living with HIV/AIDS in the United States. Previous literature is limited by the use of cross-sectional data and measures of food insecurity that have not been previously validated.

In order to address these gaps, we examined the longitudinal association between food insecurity and measures of high-risk sexual behavior in a cohort of marginally housed and homeless, HIV-infected individuals living in San Francisco using a validated measure of food insecurity. Specifically we hypothesized that individual food insecurity would be associated with (1) recent unprotected sex and (2) multiple sexual partners, both recognized risk factors for HIV transmission.

Methods

Design, Participants and Setting

Participants were from the Research on Access to Care in the Homeless (REACH) Cohort of HIV-infected homeless and marginally housed adults systematically recruited from San

San Francisco homeless shelters, free-meal programs, and single room-occupancy hotels, as previously described [1, 24]. Participants responded to structured questionnaires at baseline and at three-month intervals. In 2007, the Household Food Insecurity Access Scale (HFIAS) was introduced to routine REACH quarterly interviews and implemented continuously until the end of the study in 2010 [5]. Interviewers collected information on socio-demographics, alcohol and drug use, sexual risk behaviors, and overall mental and physical health status. From 2007 until 2010, 613 study visits were completed with sexually active participants. Participants provided written consent to participate at the onset of the study and were reimbursed \$15 per interview. The UCSF Committee on Human Research approved all study procedures.

Variable Selection

The primary outcomes of interest were any unprotected vaginal/anal sex and vaginal or anal sex with more than one partner, in the past 90 days preceding the visit. The primary independent variable was food insecurity. Food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS) [5, 25]. The HFIAS can be used to assign individuals along a continuum of food-insecurity severity, from food secure to severely food insecure. Scores range from 0 to 27; higher scores reflect more severe food insecurity [25]. Potential confounders of the association between food insecurity and high-risk sex were based on prior literature [10, 19, 21, 26–28] and included: age (years); sex; race (white vs. non-white); income (vs. < sample median); education (vs. < high school diploma); recent homelessness (sleeping on the street or shelter in past 90 days); current employment; recent drug use (any of cocaine, crack, heroin or methamphetamine) in the past 90 days; problem drinking (greater than an average of 14 drinks/week for men and 7 drinks/week for women) [29]; any incarceration in the previous 90 days; a physical health composite score (PCS) and mental health composite score (MCS) constructed from the 36-item Short Form Health Survey (SF-36); scores range from 0 to 100 where higher scores reflect better health [5, 6, 30, 31].

Statistical Analysis

We used generalized estimating equations (GEE) analyses to assess factors associated with unprotected sex and multiple sexual partners. Reports of food insecurity and risky sex outcomes were assessed at the same visit. Standard errors were calculated using an exchangeable correlation structure, adjusted by multiple observations for each individual. For each outcome, covariates associated with either unprotected sex or multiple sexual partners with a $p < 0.25$ in bivariate analysis were included in the final multivariate model. Previous literature suggests that the association of food insecurity and high-risk sexual behavior may be modified by gender, with stronger associations among women [19]. Therefore, we also constructed a model including an interaction term for food insecurity and gender. We tested the interaction between homelessness and food insecurity and between income and food insecurity [5, 7]. Because abstinence may be a form of sexual risk reduction, we conducted an additional analysis where we included all REACH participants irrespective of whether they were sexually active (with condom use and number of partnerships set to 0 for sexually inactive participants). Because we found no differences (results not shown), subsequent analyses of sexually inactive participants was not pursued. The presentation of analyses restricted to sexually active participants is also justified by prior literature investigating food insecurity and risky sexual behavior in resource rich settings [23]. All statistical procedures were performed using STATA statistical analysis software version 9 (StataCorp LP, College Station, TX, USA).

Results

Participant Characteristics

Of 331 active participants of the REACH cohort who responded to the food insecurity questionnaire, we included the 157 who reported being sexually active. Among this group, the mean age was 41.0 (SD 6.9), 68.2 % were male, 29.2 % of participants were white, and 71.4 % had completed high school. Only 12.5 % of participants were employed at baseline. Fifty-four participants (35.5 %) reported any drug in the preceding 90 days, and 9.9 % reported problem drinking in this same time period. One hundred twenty-five participants (79.6 %) reported recent food insecurity at least once. The mean HFIAS score at baseline was 4.4 (SD 5.9) (Table 1).

Determinants of Unprotected Sexual Activity

During the study period, eighty-six participants (54.8 %) engaged in unprotected intercourse. In adjusted analyses, food insecurity was independently associated with unprotected intercourse; participants had twice the odds of engaging in unprotected sex for each five-point increase, out of a possible total of 27, in the HFIAS score (AOR 2.01, 95 % C.I. = 1.31–3.10) (Table 2). In addition, participants reporting problem drinking had over a three-and-a-half times greater odds of engaging in unprotected sex (AOR 3.67, 95 % C.I. = 1.04–12.89). We did not find any significant interaction between gender, homelessness or income with food insecurity.

Determinants of Multiple Recent Sexual Partners

During the study period, 51 participants (32.5 %) reported sex with multiple partners. In adjusted analyses, each five-point increase in the HFIAS scale was associated with over one-and-a-half times greater odds (AOR 1.54, 95 % C.I. = 1.05–2.29) of having multiple sexual partners (Table 3). In addition, the odds of having multiple sexual partners were almost four times greater among white/Caucasian participants (AOR 3.80, C.I. = 1.23–11.74), five times greater among male participants (AOR 5.28, C.I. = 1.34–20.71), and two-and-a-half times greater among drug users (AOR 2.66, C.I. = 1.06–6.69). An interaction term testing the potential interaction of gender and food insecurity was non-significant.

Discussion

This study documents an association among HIV-infected individuals between increasing severity of food insecurity and having recent multiple sexual partners and an association between food insecurity and unprotected sex in a well-resourced setting [22]. In this study of HIV-infected homeless and marginally housed individuals in San Francisco, over three-quarters of participants reported food insecurity at least one time during follow-up. The prevalence of food insecurity in this study was even higher than suggested by cross-sectional studies among HIV-infected individuals in well-resourced settings, and highlights the importance of longitudinal data in understanding the episodic experience of food insecurity and its consequences [5, 6, 32]. The results reinforce that food insecurity among people living with HIV/ AIDS is a social problem not confined solely to resource-poor countries.

While food insecurity was significantly associated with both unprotected sex and sex with multiple partners, housing status and income were not. As part of the spectrum of unmet subsistence needs, these results are consistent with recent findings from a study of HIV-infected homeless and unstably housed women that found that unmet subsistence needs are stronger predictors of poor health and adherence to antiretroviral therapy when compared with other measures of socioeconomic status [33]. Taken together, these findings support the

need to target food insecurity and other unmet subsistence needs as part of HIV/AIDS care for indigent HIV-infected persons.

These findings suggest that food insecurity may be contributing to secondary HIV transmission risk among vulnerable populations. Previous studies have documented an association between food insecurity and incomplete virologic suppression, which would further compound the risk of secondary HIV transmission in the context of risky sexual behavior [14]. As a result of its strong association with risky sex, food insecurity may also be contributing to the risk of acquiring other sexual transmitted diseases, further compounding its negative impacts. This hypothesis should be assessed in future studies.

Among HIV-infected individuals, food insecurity has been associated with multiple indicators of suboptimal management of HIV-infection [11, 14, 17, 34]. International attention has recently focused on earlier antiretroviral therapy as prevention [35]. To maximize the success of “Test and Treat” paradigms, the social and structural correlates of antiretroviral success must also be addressed [35, 36]. Our results draw attention to the implications of food insecurity for ongoing HIV transmission risk, and highlight the critical need for structural interventions that address food insecurity even in well-resourced settings.

This study has several limitations. Our participants are HIV-infected homeless and marginally housed individuals in San Francisco, and the results may not be generalizable to other HIV-infected populations. However, this limitation is also strength, as it allows us to draw specific conclusions about a difficult to reach population. Some participants were recruited from free-meal program locations, which may have increased the proportion of participants with initial food insecurity. However, we do not believe recruitment site would confound the longitudinal relationship between food insecurity and our outcomes of interest. Some variables including risky sexual behaviors were measured by self-report and therefore can result in correlated measurement errors that introduce bias. Third, casual or transactional partnerships are more likely to be characterized by greater HIV transmission risk [37]. Failure to account for partner type could have confounded our estimates of the association between food insecurity and risky sexual behavior.

In summary, food insecurity is associated with multiple measures of high-risk sexual behavior among HIV-infected homeless and marginally housed individuals in San Francisco. Innovative intervention models are needed that better incorporate targeted food insecurity interventions into routine HIV care and programming. In addition to improving HIV/AIDS health outcomes, such measures to alleviate food insecurity may also play a role in decreasing secondary HIV transmission and preventing acquisition of other sexually transmitted diseases in this population.

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Table 1
Baseline characteristics of sexually active homeless and unstably housed adults in the REACH cohort, San Francisco, 2007–2010, $n = 157$

Characteristic	
Age [mean (SD)]	41.0 (SD 6.90)
White (vs. nonwhite)	45 (29.2 %)
Male (vs. female)	105 (68.2 %)
Heterosexual	59 (37.6 %)
Recent homelessness past 90 days	13 (8.3 %)
High school education	110 (71.4 %)
Employed	19 (12.5 %)
Income [median (SD)]	930 (SD 481)
Recent incarceration past 90 days	17 (10.8 %)
Any drug use past 90 days	54 (35.5 %)
Problem drinking past 90 days	15 (9.9 %)
Overall physical health ^a	42.6 (SD 10.4)
Overall mental health ^b	45.5 (SD 12.6)
Severity of food insecurity [mean (SD)] ^c	4.4 (SD 5.9)

^aSF-36 score ranges from 0 to 100 where an increasing score indicates better health

^bWare JJ, Snow K, Kosinski M, Gandek B. Health survey: SF-36 health survey: manual and interpretation guide. Boston: The Health Institute 1993

^cHFIAS scores range from 0 to 27 where higher scores indicate more severe food insecurity

Table 2
Unadjusted and adjusted associations with unprotected sex among sexually active homeless and unstably housed adults in the REACH cohort, San Francisco, 2007–2010

Characteristic	Odds ratio (95 % CI)	Adjusted OR (95 % CI)
Severity of food insecurity (each five point increase)	2.04 (1.41–2.95) **	2.01 (1.31–3.10) **
Age (per year)	0.99 (0.91–1.07)	–
White (vs. nonwhite)	2.18 (0.63–7.60)	–
Male (vs. female)	1.92 (0.57–6.49)	–
Heterosexual	0.42 (0.13–1.38)	–
Recent homelessness past 90 days	1.43 (0.32–6.36)	–
High school education	2.30 (0.65–8.13)	–
Employed	0.53 (0.18–1.59)	–
Income (median of \$930/month)	1.46 (0.68–3.15)	–
Recent incarceration past 90 days	1.83 (0.71–4.73)	–
Drug use past 90 days	2.25 (0.95–5.30)	–
Problem drinking past 90 days	2.85 (0.88–9.26)	3.67 (1.04–12.89) *
Overall physical health (one unit increase)	0.99 (0.95–1.03)	–
Overall mental health (one unit increase)	0.99 (0.96–1.02)	–

* *p value* 0.05;

** *p value* 0.001

Table 3
Unadjusted and adjusted associations of sex with multiple partners among sexually active homeless and unstably housed adults in the REACH cohort, San Francisco, 2007–2010

Characteristic	Odds ratio (95 % CI)	Adjusted OR (95 % CI)
Severity of food insecurity (each 5 point increase)	1.61 (1.22–2.19)	1.54 (1.05–2.29) *
Age (per year)	1.01 (0.93–1.09)	–
White (vs. nonwhite)	5.13 (1.58–16.67)	3.80 (1.23–11.74) *
Male (vs. female)	6.30 (1.62–24.52)	5.28 (1.34–20.71) *
Heterosexual	0.45 (0.14–1.44)	–
Recent homelessness past 90 days	0.71 (0.16–3.24)	–
High school education	2.77 (0.75–10.18)	–
Employed	1.42 (0.42–4.77)	–
Income (median of \$930/ month)	2.10 (0.89–1.21)	–
Recent incarceration past 90 days	1.94 (0.74–4.92)	–
Drug use past 90 days	5.07 (2.05–12.54)	2.66 (1.06–6.69) *
Problem drinking past 90 days	1.53 (0.45–5.27)	–
Overall physical health (one unit increase)	1.01 (0.96–1.05)	–
Overall mental health (one unit increase)	0.97 (0.94–1.01)	–

* *p* value 0.05