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Medication Adherence Challenges among HIV Positive Substance Abusers: The Role of Food and Housing Insecurity

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Abstract

This study examines the prevalence of food/housing insecurity and its association with psychological, behavioral and environmental factors impacting ARV medication adherence and diversion among substance using HIV+ patients in South Florida. 503 HIV+ substance abusers were recruited through targeted sampling. Participants completed a standardized instrument assessing demographics, mental health status, sex risk behaviors, HIV diagnosis, treatment history and access, ARV adherence and diversion, and attitudes toward health care providers. Chi-square and t-tests were used to examine differences by food/housing status and a multivariate linear regression model examined food/housing insecurity and its associations to ARV adherence. Food/housing insecurity was reported by 43.3% of the sample and was associated with higher likelihood of severe psychological distress and substance dependence. Nearly 60% reported recent ARV diversion; only 47.2% achieved 95% medication adherence over one week. Food/housing insecure participants had deficits in their HIV care, including less time in consistent care, lower access to medical care, and less favorable attitudes toward care providers. Multivariate linear regression showed food/housing insecurity demonstrated significant main effects on adherence, including lower past week adherence. Medication diversion was also associated with reduced adherence. Our findings suggest that food/housing insecurity operates as a significant driver of ARV non-adherence and diversion in this population. In the pursuit of better long term health outcomes for vulnerable HIV+ individuals, it is essential for providers to understand the role of food and housing insecurity as a stressor that negatively impacts ARV adherence and treatment access, while also significantly contributing to higher levels distress and substance dependence.

Keywords

food and housing insecurity; ARV adherence; substance abuse

Food insecurity is a public health problem of staggering proportions, affecting more than 1 billion people globally (Weiser, et al., 2011). Growing numbers of individuals in high resource contexts are adversely impacted by insufficient food resources; in the United

States, some 18 million households are classified as food insecure, with access to adequate food restricted by lack of money or other resources (Coleman-Jensen, Nord, Andrews, & Carlson, 2012). Food insecurity has been associated with poor health status among the US general population, including chronic diseases such as hypertension, diabetes, and obesity (Dinour, Bergen, & Yeh, 2007; Seligman, Laraia, & Kushel, 2010), and has also been cited as a significant barrier to health care access (Anema, Vogenthaler, Frongillo, Kadiyala, & Weiser, 2009). Similar observations have been made regarding homelessness and housing instability, which have been repeatedly linked to poor health, premature mortality (O'Connell, et al., 2010) and inadequate medical care access among individuals in the US (Kushel, Gupta, Gee, & Haas, 2006).

Food insecurity has been widely examined as a risk factor for both HIV acquisition and HIV disease progression in the developing world, with several studies showing clear associations between food insecurity and increased sexual risk taking, reduced antiretroviral (ARV) adherence, reduced access to HIV treatment, and poorer clinical outcomes among HIV-infected populations (Reddi, Powers, & Thyssen, 2012; Weiser, et al., 2012; Weiser, et al., 2011). Although less common, research in high-resource contexts reports similar findings; a high prevalence of food insecurity is present among HIV-positive individuals, and particularly substance users, in both the US and Canada (Anema, et al., 2009; Vogenthaler, et al., 2010), and is associated with increased sexual risk behaviors (Shannon, et al., 2011), reduced ARV adherence (Strike, Rudzinski, Patterson, & Millson, 2012), decreased viral suppression (Vogenthaler, et al., 2010) and increased mortality (Weiser, et al., 2009). In a similar way, housing instability increases risk for ARV adherence problems, lower viral suppression, and poorer health outcomes among HIV+ individuals (Leaver, Bargh, Dunn, & Hwang, 2007; Milloy, et al., 2012; A. Palepu, Milloy, Kerr, Zhang, & Wood, 2011). Housing instability and food insecurity are often intertwined among impoverished HIV positive individuals (Vogenthaler, et al., 2010; Weiser, et al., 2011), indicating a high level of competing subsistence needs in this vulnerable population.

A number of pathways have been proposed to account for the links between food insecurity and HIV, including individual behaviors, household-level characteristics, and structural factors such as poverty, reduced economic opportunities, and stigma (Strike, et al., 2012). In a comprehensive review, Weiser and colleagues (Weiser, et al., 2011) proposed three primary pathways (nutritional, behavioral, and psychological) for understanding the connection of food insecurity and HIV acquisition and progression. Food insecurity can impact health directly through inadequate nutrition and nutrient deficits (Anema, et al., 2009), but also operate indirectly via adverse psychological effects and behavioral strategies that influence health outcomes. In this regard, the immediate need for adequate food can lead to the adoption of risky behaviors and coping strategies, such as sex exchange, which increases the risk for HIV acquisition (Ivers, et al., 2009); similarly, stress associated with inadequate financial resources to meet basic needs (e.g. food and shelter) can increase both psychological distress and substance use (Weiser, et al., 2011), which in turn predict ARV adherence and virologic failure among HIV-positive individuals over time (Mugavero, et al., 2009). Negative behavioral coping, such as missed HIV clinic visits and ARV medication interruptions, is also linked to poorer health and virologic outcomes among vulnerable individuals (Weiser, et al., 2011).

The current paper examines the prevalence of food and housing insecurity among substance using HIV positive patients in South Florida, and explores the association of food and housing insecurity with psychological distress and poor behavioral coping strategies, including ARV non-adherence and ARV diversion. The unlawful sale and trading of ARV medications, or diversion, was recently documented among indigent HIV+ patients in urban South Florida (Surratt, Kurtz, Cicero, O'Grady, & Levi-Minzi, 2013), but has not been studied in relation to food insecurity. This paper extends prior research by examining multiple psychological, behavioral, and environmental domains impacting ARV treatment adherence among highly vulnerable HIV+ individuals.

METHODS

Target Population and Study Eligibility

The target population for this study was indigent HIV-positive substance users in South Florida. Study inclusion criteria were: age 18 or older; cocaine or heroin use 12 or more times in the prior 3 months; documented HIV+ status; and, current ARV prescription. In addition, diverters endorsed at least one occasion of ARV diversion in the prior 3 months.

Study Recruitment

Participants were located through targeted sampling techniques (Watters & Biernacki, 1989), which have been used extensively for studying hard-to-reach populations. Two primary elements of targeted sampling guided recruitment: 1) the identification of specific geographic areas (defined by high HIV prevalence/high poverty zip code boundaries); and, 2) information on ARV diversion from key informants (KIs) in the targeted communities (including treatment professionals, community outreach workers, HIV service providers, as well as a variety of street-level drug users). Initial recruitment efforts targeted the geographically clustered communities to the north of downtown Miami that are intersected by the highest rates of HIV/AIDS (Miami Dade County Department of Health, 2012) and highest poverty indices in Miami-Dade County, and were subsequently expanded to other locales based on information from KIs. Study recruitment was carried out by a team of professional field staff and outreach workers. Direct outreach was utilized to distribute study information cards and flyers in a variety of street venues and community-based HIV service organizations within the identified target areas.

Study Procedures

Study recruiters made contact with potential participants in various street and service locations in accordance with the targeted sampling plan. Potential participants were given contact information for the project, and were asked to participate in telephone screening for eligibility. Those meeting project eligibility requirements were scheduled for appointments at the field site, where they were re-screened. In total, 2,112 individuals were screened for the study, 599 met study eligibility criteria, and 503 were enrolled. By design, we enrolled approximately equal numbers diverting their personal ARV(s) (N=251) and not (N=252). After eligibility was confirmed, informed consent was obtained. A one-time standardized assessment was then administered, which took approximately one hour to complete. Participants were paid a \$30 stipend upon completion of the interview, and were offered a

variety of educational and risk reduction materials. All project staff completed the requirements for National Institutes of Health (NIH) web-based certification for protection of human subjects. Study protocols were approved by the University of Delaware's (predecessor institution) and Nova Southeastern University Institutional Review Boards. A Certificate of Confidentiality from the National Institutes of Health was also obtained and a copy was offered to participants.

Data Collection and Measures

Trained interviewers conducted computer-assisted personal interviews (CAPI). Interviews were offered in either English or Spanish, according to the participant's language preference. Three members of the interview team were fully bilingual. The Global Appraisal of Individual Needs (GAIN, v. 5.4; (Dennis, Titus, White, Unsicker, & Hodgkins, 2002)) was the primary component of the standardized assessment. The GAIN captures information on demographics, mental health status, including DSM-IV depression and anxiety measures, services utilization, trauma and victimization, substance use and DSM-IV dependence, and sexual risk behaviors, and has established reliabilities. Standardized instruments also assessed HIV diagnosis/treatment history (RAND Corporation, 2006), ARV adherence (Chesney, et al., 2000), attitudes toward HIV care providers, (Bodenlos, et al., 2004) and HIV treatment access (RAND Corporation, 1998); a newly developed instrument assessed ARV diversion.

Demographic information gathered on study participants included age, race/ethnicity, gender, and level of education. Data were collected on a variety of contemporary life stressors, including financial, legal, medical, and relationship issues, using items adapted from the CRISYS life stress scale (Shalowitz, Berry, Rasinski, & Dannhausen-Brun, 1998); this instrument was specifically developed to examine salient stressors for low-income, vulnerable populations. Food/housing insecurity was examined using a single adapted item: In the 3 months prior to interview, did you go without food, housing, or other necessities because you did not have the money? Food/housing insecurity was the primary independent variable for analysis, allowing for examination of participants' unmet subsistence needs and their association with ARV adherence.

Health status was measured by three items: perceived general health in the past year, ranging from poor to excellent on a 5 point scale. HIV clinical outcomes were assessed by self-report of most recent CD4 count and viral load. Viral load was dichotomized into undetectable versus not.

Psychological factors—Mental health subscales in the GAIN are based on DSM-IVR criteria: 9 items assess depression symptoms, 12 items assess anxiety symptom, and 13 items assess traumatic stress over a 12 month period (Bohlig & Dennis, 1996; Dennis, et al., 2002). In all cases, higher scores indicate greater problem severity. Summary scores yield classifications of: none/minimal (0–1), moderate (2–5) and severe (6–9) for depression; none/minimal (0–1), moderate (2–6), and severe (7–12) for anxiety; and, none (0), moderate (1–4) and severe (5–13) for traumatic stress. Alpha reliability coefficients for the depression, anxiety, and traumatic stress scales were 0.87, 0.88, and 0.83, respectively.

Substance dependence was assessed using DSM-IV criteria, which consists of seven items measuring past year drug problem severity. Endorsement of six or more items (e.g. using more or longer than intended, withdrawal problems) resulted in classification of *severe* dependence. The alpha reliability coefficient for the DSM-IV dependence scale was 0.83.

Behavioral Factors—Participants self-reported ARV adherence in the past seven days using the ACTG instrument (Chesney, et al., 2000); information was gathered on total ARV doses prescribed and total doses missed in this time period. Using these data, weekly ARV doses taken were computed and divided by total doses prescribed to generate an adherence percentile score. ARV diversion was measured by the following item: “When was the last time, if ever, that you sold or traded any of your HIV medications to another person for any reason?” For analysis, this variable was dichotomized into “within the past 3 months” or “not within the past three months”.

Environmental Factors—Participants reported perceptions of their HIV medical providers’ professionalism and emotional support using an abbreviated version of the Attitudes toward HIV Health Care Providers Scale (Bodenlos, et al., 2004). Scores ranged from 12–48, with higher scores indicating more positive attitudes. The alpha reliability coefficient for this scale was 0.87.

General access to healthcare was assessed using an adaptation of the Health Cost and Services Utilization Study Questionnaire (RAND Corporation, 1998). Perceived access to health care was measured by 7 items, including access to specialists and hospital care. Scores ranged from 7 to 28; higher scores reflect greater perceived access to care. The alpha reliability coefficient for this scale was 0.87. A single variable assessing time with regular source of HIV care was also utilized from this questionnaire.

Data Analysis

503 eligible participants were enrolled in the study between 2010 and 2012. Data from the interview questionnaires were analyzed using *SPSS for Windows*. Descriptive statistics were calculated to describe the sample in terms of food/housing insecurity. Chi-square and t-tests were utilized to examine differences in socio-demographic (age, gender, race, education), environmental (HIV treatment access, attitudes toward providers, HIV care stability), psychological (depression, anxiety, traumatic stress, substance dependence), and behavioral domains (ARV adherence, ARV diversion) by food/housing status.

Subsequently, a multivariate linear regression model was constructed to examine whether food/housing insecurity was significantly associated with past week ARV treatment adherence, while controlling for variables displaying significant differences in the initial descriptive analyses. For the regression analysis, percent ARV adherence was the outcome of interest and was treated as a continuous variable. Depression, anxiety, traumatic stress, and substance dependence measures were included as continuous variables, using total symptom counts. Multicollinearity analyses were conducted for the independent variables of interest, including food/housing insecurity, depression, anxiety, trauma, substance dependence, HIV treatment access, months in HIV care, attitudes toward HIV providers, and ARV diversion. Depression and anxiety symptoms were highly correlated (0.80), as were

anxiety and traumatic stress (0.71) but no evidence of multicollinearity was observed upon examining the variance inflation factors (VIF < 4). Variance inflation and correlation coefficients were within acceptable limits for all other variables; however, the condition index for the measure of attitudes toward care providers exceeded 30 (Callaghan & Chen, 2008), and this variable was removed from the model to reduce collinearity. Variables were entered simultaneously into the linear regression model.

RESULTS

The prevalence of recent food/housing insecurity among this sample of HIV-positive substance users was elevated at 43.3%. As indicated in Table 1, the inability to consistently meet food/housing subsistence needs was associated with a number of health disparities, including significantly higher likelihood of severe psychological distress (*depression* 73.4% vs. 40.4%, $\chi^2 < .01$; *anxiety* 49.1% vs. 17.9%, $\chi^2 < .01$; *traumatic stress* 77.5% vs. 49.8%, $\chi^2 < .01$), severe substance dependence (70.2% vs. 43.9%, $\chi^2 < .01$), and lower likelihood of achieving an undetectable viral load (46.2% vs. 57.0%, $\chi^2 = .02$).

Food/housing insecure participants were also significantly more likely to report poor behavioral coping, with nearly 60% endorsing diversion of their ARV medications in the past three months (59.6% vs. 42.5%, $\chi^2 < .01$). Past week ARV treatment adherence levels also suffered among the food/housing insecure, with just 47.2% achieving gold-standard 95% medication adherence in this brief time period (47.2% vs. 59.3%, $\chi^2 < .01$). Food/housing insecure participants also reported significant comparative deficits in their HIV care environment; In particular, this group on average had less time in consistent, stable care (50.2 months vs. 66.1, $t=3.0$; $p < .01$), reported lower access to both routine and emergency medical care (22.5 vs. 24.8, $t=5.8$; $p < .01$), and reported less favorable attitudes toward their HIV care providers (42.7 vs. 44.6, $t=3.8$; $p < .01$).

Table 2 presents the results of the multivariate linear regression model examining the impact of food/housing insecurity, DSM-IV depression, anxiety, traumatic stress, and substance dependence, time in HIV care, HIV treatment access, and ARV diversion on ARV adherence. Food/housing insecurity and ARV diversion demonstrated significant main effects on adherence: food/housing insecurity was associated with lower past week HIV medication adherence ($\beta = -0.062$, $p=0.044$); likewise, endorsement of HIV medication diversion was also associated with reduced HIV medication adherence ($\beta = -0.227$, $p < 0.01$), compared with non diverters. The regression model had an adjusted R square of 0.156.

DISCUSSION

The present study documented an elevated prevalence of recent food/housing insecurity among indigent HIV+ substance abusers in South Florida, with 43% reporting the inability to meet these basic needs due to a lack of financial resources. This finding resonates with other literature among highly vulnerable samples of drug users and HIV+ individuals in both the US and Canada, where the prevalence of food insecurity has ranged from 34 to 54% (Anema, et al., 2009; Vogenthaler, et al., 2010). These data reflect the difficult daily realities of impoverished individuals managing a complex and chronic illness in a context where

routine access to the most basic necessities is lacking. Our data contribute to the existing literature by demonstrating that food/housing insecurity is a significant environmental stressor, broadly contributing to higher psychological distress, higher substance dependence, lower ARV adherence, lower access to health care, and higher viral load in our sample of vulnerable HIV+ individuals. These findings are consistent with prior work examining environmental stressors in poverty contexts, which indicates that neighborhood level disorder and disorganization can impact psychological distress (Hill, Burdette, & Hale, 2009; Hill, Ross, & Angel, 2005; Latkin, Williams, Wang, & Curry, 2005), HIV risk behaviors and health outcomes (Latkin & Curry, 2003; Ross & Mirowsky, 2001).

Our data show that indigent substance abusing patients with high levels of competing needs face challenges with ARV adherence. Active substance use has been a well documented predictor of poor ARV medication adherence in a variety of studies (Arnsten, et al., 2002; Celentano & Lucas, 2007; Gebo, Keruly, & Moore, 2003; Halkitis, Palamar, & Mukherjee, 2008; Johnson, et al., 2003; Levine, et al., 2005; Lucas, Cheever, Chaisson, & Moore, 2001; Anita Palepu, Horton, Tibbetts, Meli, & Samet, 2004; Tucker, Burnam, Sherbourne, Kung, & Gifford, 2003) and this has been attributed to a variety of factors, including the competing demands of drug seeking and use, poor psychological functioning, social instability, chaotic lifestyles, and poor quality health care (Hinkin, et al., 2004; Ingersoll & Heckman, 2005; Sharpe, Lee, Nakashima, Elam-Evans, & Fleming, 2004). The present study documented modest ARV adherence levels overall, and found that food/housing insecurity further reduced ARV adherence, after controlling for substance dependence, psychological distress, and other factors. Moreover, these factors can be synergistic, creating a recursive cycle that perpetuates negative health consequences. These findings suggest that healthcare providers should routinely assess unmet subsistence needs among vulnerable HIV+ patients, as appropriate assistance programs could be targeted.

Food/housing insecurity was also linked to the diversion of ARVs, which in turn was associated with reduced adherence. Our data provide evidence that ARV diversion by indigent HIV+ patients is driven, at least in part, by inconsistent access to basic resources that renders individuals vulnerable to poor behavioral coping. The priority of immediate health and safety concerns appears to directly impact medication diversion decisions, with individuals sacrificing longer-term health benefits in order to manage daily life stressors. The expense of ARV medications has made these drugs increasingly vulnerable to diversion due to their high cost and consequent high value on the black market (Allen, 2007; Beras, 2007; Flaherty & Gaul, 2003; LaPadula, 2005; Surratt, et al., 2013), and for patients already marginalized by poverty, homelessness, substance use, and other environmental stressors, negligible monetary incentives can influence their engagement in diversion (Surratt, et al., 2013). Recognition of ARV diversion as a potential barrier to ARV adherence and viral suppression assumes great importance for public health professionals and HIV care providers who interact with highly vulnerable patient caseloads.

Limitations

This study has limitations which should be noted. First, although study data were gathered from a large sample of HIV+ substance abusers, the sample is not representative.

Recruitment was limited to drug-involved, impoverished individuals, and targeted specific geographic areas with high poverty concentrations. As well, the focus on ARV diversion likely yielded a sample different from other HIV+ community-based samples, and as a consequence generalizability is limited. An additional limitation involves the use of self-report data and the potential for reporting biases. Recall problems and social desirability biases may have influenced participant responses in some cases, though the high levels of drug use, diversion, and low adherence reported suggest that data were not biased by substantial under-reporting of socially undesirable behaviors.

A particularly important study limitation relates to the measurement of food/housing insecurity using a single dichotomous item. Data were drawn from an exploratory study designed to capture information on a wide array of individual and environmental-level factors hypothesized to be linked to ARV diversion and non-adherence, and as such, the brief measurement of financial stressors lacked some key details. In this regard, the use of a combined food/housing item rendered us unable to examine the potentially unique contributions of food versus housing insecurity to ARV adherence. Although prior research has indicated that food insecurity and housing instability are often experienced jointly by vulnerable populations (Kushel, Gupta, Gee, & Haas, 2006; Vogenthaler, et al., 2010), disentangling the independent effects of these unique unmet needs is an important direction for future research, given the differing implications for intervention that each confers.

CONCLUSION

Despite these limitations, data from the present study clearly indicate that food/housing insecurity operates as a significant driver of ARV non-adherence in this indigent patient population. Understanding the role of acute environmental stressors such as these in impacting personal health behaviors may be useful to inform screening, assessment and intervention efforts by healthcare providers. Provider-initiated dialogues to engage vulnerable patients in sensitive discussions regarding personal and environmental barriers to their HIV treatment plans appear critical. Furthermore, our findings point to the need for the large scale implementation of comprehensive, wrap around services in primary care settings to address unmet food and housing needs among highly marginalized patients with HIV.

References

- Allen, G. Medicare Fraud Acute in South Florida. 2007. Retrieved February 21, 2008, from <http://www.npr.org/templates/story/story.php?storyId=15178883>
- Anema A, Vogenthaler N, Frongillo EA, Kadiyala S, Weiser SD. Food insecurity and HIV/AIDS: Current knowledge, gaps, and research priorities. *Current HIV/AIDS Reports*. 2009; 6:224–231. [PubMed: 19849966]
- Arnsten JH, Demas PA, Grant RW, Gourevitch MN, Farzadegan H, Howard AA, et al. Impact of Active Drug Use on Antiretroviral Therapy Adherence and Viral Suppression in HIV-Infected Drug Users. *Journal of General Internal Medicine*. 2002; 17(5):377–381. [PubMed: 12047736]
- Beras, E. Bus Carrying \$1 Million in HIV Drugs Halted. 2007. 2 Held, February 21, from <http://ww1.aegis.org/news/mh/2007/MH070901.html>
- Bodenlos JS, Grothe KB, Kendra K, Whitehead D, Copeland AL, Brantley PJ. Attitudes toward HIV health care providers scale: Development and validation. *AIDS Patient Care and STDs*. 2004; 18(12):714–720. [PubMed: 15659882]

- Bohlig, EM.; Dennis, ML. Development of an abbreviated symptom checklist: Preliminary analysis of the HSCL-90 in a methadone-maintenance population. Research Triangle Park, NC: Research Triangle Institute; 1996.
- Callaghan, K.; Chen, J. Revisiting the collinear data problem: An assessment of estimator 'ill-conditioning' in linear regression. Practical Assessment, Research & Evaluation. 2008. Retrieved August 29, 2013, from <http://pareonline.net/pdf/v13n5.pdf>
- Celentano DD, Lucas G. Optimizing treatment outcomes in HIV-infected patients with substance abuse problems. *Clinical Infectious Diseases*. 2007; 45(Supplement 4):318–323.
- Chesney MA, Ickovics JR, Chambers DB, Gifford AL, Neidig J, Zwickl B, et al. Self-reported adherence to antiretroviral medications among participants in HIV clinical trials: The AACTG adherence instruments. *AIDS Care*. 2000; 12(3):255–266. [PubMed: 10928201]
- Coleman-Jensen, A.; Nord, M.; Andrews, M.; Carlson, S. Household food security in the United States in 2011. ERS Report Summary. 2012. Retrieved August 29, 2013, from <http://www.ers.usda.gov/publications/err-economic-research-report/err141/report-summary.aspx>
- Dennis, ML.; Titus, JC.; White, MK.; Unsicker, JL.; Hodgkins, D. Global Appraisal of Individual Needs – Initial (GAIN-I). Bloomington, IL: Chestnut Health Systems; 2002.
- Dinour LM, Bergen D, Yeh MC. The food insecurity-obesity paradox: A review of the literature and the role food stamps may play. *Journal of the American Dietetic Association*. 2007; 107:1952–1961. [PubMed: 17964316]
- Flaherty MP, Gaul GM. Florida Medicaid fraud costs millions, report says. *Washington Post*. 2003 Dec 19.:E03.
- Gebo KA, Keruly J, Moore RD. Association of social stress, illicit drug use, and health beliefs with non-adherence to antiretroviral therapy. *Journal of General Internal Medicine*. 2003; 18(2):104–111. [PubMed: 12542584]
- Halkitis P, Palamar J, Mukherjee P. Analysis of HIV medication adherence in relation to person and treatment characteristics using hierarchical linear modeling. *AIDS Patient Care and STDs*. 2008; 22(4):1–12. [PubMed: 18095836]
- Hill TD, Burdette AM, Hale L. Neighborhood disorder, sleep quality, and psychological distress: Testing a model of structural amplification. *Health & Place*. 2009; 15:1006–1013. [PubMed: 19447667]
- Hill TD, Ross CE, Angel RJ. Neighborhood disorder, psychophysiological distress, and health. *Journal of Health and Social Behavior*. 2005 Jun.46:170–186. [PubMed: 16028456]
- Hinkin CH, Hardy DJ, Mason KI, Castellon SA, Durvasula RS, Lam MN, et al. Medication adherence in HIV-infected adults: Effect of patient age, cognitive status, and substance abuse. *AIDS*. 2004; 18(Suppl. 1):S19–S25. [PubMed: 15075494]
- Ingersoll KS, Heckman CJ. Patient-clinician relationships and treatment system effects on HIV medication adherence. *AIDS and Behavior*. 2005; 9(1):89–101. [PubMed: 15812616]
- Ivers LC, Cullen KA, Freedberg KA, Block S, Coates J, Webb P. HIV/AIDS, undernutrition, and food insecurity. *Clinical Infectious Diseases*. 2009; 49:1096–1102. [PubMed: 19725790]
- Johnson MO, Catz SL, Remien RH, Rotheram-Borus MJ, Morin SF, Charlebois E, et al. Theory-guided, empirically supported avenues for intervention on HIV medication nonadherence: Findings from the Healthy Living Project. *AIDS Patient Care and STDs*. 2003; 17(12):645–656. [PubMed: 14746658]
- Kushel MB, Gupta R, Gee L, Haas JS. Housing instability and food insecurity as barriers to health care among low-income Americans. *Journal of General Internal Medicine*. 2006; 21:71–77.10.1111/j.1525-1497.2005.00278.x [PubMed: 16423128]
- LaPadula P. Four Arrested in Miami AIDS Drug Scheme: Defendants Accused of Selling Drugs on the Black Market. *Express Gay News*. 2005 Dec 9.
- Latkin CA, Curry AD. Stressful neighborhoods and depression: A prospective study of the impact of neighborhood disorder. *Journal of Health and Social Behavior*. 2003; 44(1):34–44. [PubMed: 12751309]
- Latkin CA, Williams CT, Wang J, Curry AD. Neighborhood social disorder as a determinant of drug injection behaviors: A structural equation modeling approach. *Health Psychology*. 2005; 24(1):96–100. [PubMed: 15631567]

- Leaver CA, Bargh G, Dunn JR, Hwang SW. The effects of housing status on health-related outcomes in people living with HIV: A systematic review of the literature. *AIDS and Behavior*. 2007; 11:S85–S100.10.1007/s10461-007-9246-3
- Levine AJ, Hinkin CH, Castellon SA, Mason KI, Lam MN, Perkins A, et al. Variations in Patterns of Highly Active Antiretroviral Therapy (HAART) Adherence. *AIDS and Behavior*. 2005; 9(3):355–362. [PubMed: 16088365]
- Lucas GM, Cheever LW, Chaisson RE, Moore RD. Detrimental effects of continued illicit drug use on the treatment of HIV-1 infection. *Journal of Acquired Immune Deficiency Syndromes*. 2001; 27(3):251–259. [PubMed: 11464144]
- Miami Dade County Department of Health. Miami-Dade County Reported HIV (Not AIDS) Cases Through 2012. 2012. Retrieved August 29, 2013, from <http://www.dadehealth.org/downloads/2012%20HIV%20Reported.pdf>
- Milloy MJ, Marshall BD, Kerr T, Buxton J, Rhodes T, Montaner J, et al. Social and structural factors associated with HIV disease progression among illicit drug users: A systematic review. *AIDS*. 2012; 26(9):1049–1063. [PubMed: 22333747]
- Mugavero MJ, Raper JL, Reif S, Whetten K, Leserman J, Thielman NM, et al. Overload: Impact of incident stressful life events on antiretroviral medication adherence and virologic failure in a longitudinal, multisite human immunodeficiency virus cohort study. *Psychosomatic Medicine*. 2009; 71:920–926. [PubMed: 19875634]
- O’Connell JJ, Oppenheimer SC, Judge CM, Taube RL, Blanchfield BB, Swain SE, et al. The Boston Health Care for the Homeless program: A public health framework. *American Journal of Public Health*. 2010; 100(8):1400–1408. [PubMed: 20558804]
- Palepu A, Horton NJ, Tibbetts N, Meli S, Samet JH. Uptake and adherence to highly active antiretroviral therapy among HIV-infected people with alcohol and other substance use problems: The impact of substance abuse treatment. *Addiction*. 2004; 99(3):361–368. [PubMed: 14982549]
- Palepu A, Milloy MJ, Kerr T, Zhang R, Wood E. Homelessness and adherence to antiretroviral therapy among a cohort of HIV-infected injection drug users. *Journal of Urban Health*. 2011; 88(3):545–555. [PubMed: 21409604]
- RAND, Corporation. HIV Cost and Services Utilization Study Survey. 1998. Retrieved August 29, 2013, from http://www.rand.org/content/dam/rand/www/external/health/surveys_tools/hcsus/hcsussurvey.pdf
- RAND Corporation. Disparities in care for HIV patients. Santa Monica, CA: RAND Health; 2006.
- Reddi A, Powers MA, Thyssen A. HIV/AIDS and food insecurity: Deadly syndemic or an opportunity for healthcare synergism in resource-limited settings of sub-Saharan Africa? *AIDS*. 2012; 26:115–117. [PubMed: 22126815]
- Ross CE, Mirowsky J. Neighborhood disadvantage, disorder and health. *Journal of Health and Social Behavior*. 2001; 42(3):258–276. [PubMed: 11668773]
- Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *The Journal of Nutrition*. 2010; 140(2):304–310. [PubMed: 20032485]
- Shalowitz MU, Berry CA, Rasinski KA, Dannhausen-Brun CA. A new measure of contemporary life stress: Development, validation, and reliability of the CRISYS. *Health Services Research*. 1998; 33(5):1381–1402. [PubMed: 9865225]
- Shannon K, Kerr T, Milloy MJ, Anema A, Zhang R, Montaner JSG, et al. Severe food insecurity is associated with elevated unprotected sex among HIV-seropositive injection drug users independent of HAART use. *AIDS*. 2011; 25:2037–2042. [PubMed: 21811140]
- Sharpe TT, Lee LM, Nakashima AK, Elam-Evans LD, Fleming PL. Crack cocaine use and adherence to antiretroviral treatment among HIV-infected black women. *Journal of Community Health*. 2004; 29(2):117–127. [PubMed: 15065731]
- Strike C, Rudzinski K, Patterson J, Millson M. Frequent food insecurity among injection drug users: Correlates and concerns. *BMC Public Health*. 2012; 12(1058):1–9. Retrieved from <http://www.biomedcentral.com/1471-2458/12/1058>. [PubMed: 22214479]

- Surratt HL, Kurtz SP, Cicero TJ, O'Grady C, Levi-Minzi MA. Antiretroviral medication diversion among HIV-positive substance abusers in South Florida. *American Journal of Public Health*. 2013; 106(6):1026–1028.10.2105/AJPH.2012.301092 [PubMed: 23597362]
- Tucker JS, Burnam A, Sherbourne CD, Kung FY, Gifford AG. Substance use and mental health correlates of nonadherence to antiretroviral medications in a sample of patients with Human Immunodeficiency Virus infection. *The American Journal of Medicine*. 2003; 114:573–580. [PubMed: 12753881]
- Vogenthaler NS, Hadley C, Lewis SJ, Rodriguez AE, Metsch LR, del Rio C. Food insufficiency among HIV-infected crack-cocaine users in Atlanta and Miami. *Public Health Nutrition*. 2010; 13(9):1478–1484. [PubMed: 20074395]
- Watters JK, Biernacki P. Targeted sampling: Options for the study of hidden populations. *Social Problems*. 1989; 36(4):416–430.
- Weiser SD, Fernandes KA, Brandon EK, Lima VD, Anema A, Bangsberg DR, et al. The association between food insecurity and mortality among HIV-infected individuals on HAART. *Journal of Acquired Immune Deficiency Syndrome*. 2009; 52(3):342–349.
- Weiser SD, Gupta R, Tsai AC, Frongillo EA, Grede N, Kumbakumba E, et al. Changes in food insecurity, nutritional status, and physical health status after antiretroviral therapy initiation in rural Uganda. *Journal of Acquired Immune Deficiency Syndrome*. 2012; 61(2):179–186.
- Weiser SD, Young SL, Cohen CR, Kushel MB, Tsai AC, Tien PC, et al. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. *American Journal of Clinical Nutrition*. 2011; 94(Supplement):1729s–1739s. [PubMed: 22089434]

Table 1

Food/housing Insecurity among HIV+ Substance Abusers in South Florida, (N=503)

	FH Insecure n=218	FH Secure n=285	T or chi square	Sign. level
<i>Demographics</i>				
Age, mean (SD)	45.8 (7.8)	46.3 (7.7)	.69	.49
Male gender, n (%)	129 (59.2)	170 (59.6)	.01	.91
African American, n (%)	135 (61.9)	206 (72.3)	6.07	.01
HS Education, n (%)	112 (51.4)	172 (60.4)	4.05	.04
Years HIV diagnosis, mean (SD)*	12.5 (7.1)	13.3 (7.4)	1.20	.23
<i>Health Status</i>				
Good+ self-reported health, n (%)	88 (40.4)	161 (56.5)	12.85	.00
Current CD4, mean (SD)*	448.2 (271.7)	492.6 (290.5)	1.67	.10
Undetectable Viral Load, n (%)*	91 (46.2)	146 (57.0)	5.24	.02
<i>Psychological Factors</i>				
Severe Depression, n (%)	160 (73.4)	115 (40.4)	54.42	.00
Severe Anxiety, n (%)	107 (49.1)	51 (17.9)	55.77	.00
Severe Traumatic Stress, n (%)	169 (77.5)	142 (49.8)	40.15	.00
Severe Substance Dependence, n (%)	153 (70.2)	125 (43.9)	34.62	.00
<i>Behavioral Factors</i>				
95% ARV Adherence in past week, n (%)	103 (47.2)	169 (59.3)	7.22	.00
ARV Diversion in past 90 Days, n (%)	130 (59.6)	121 (42.5)	14.58	.00
<i>Environmental/Care Factors</i>				
Months in Stable HIV Care, mean (SD)	50.2 (54.3)	66.1 (63.6)	3.03	.00
HIV Treatment Access, mean (SD)	22.5 (4.7)	24.8 (3.7)	5.84	.00
Attitudes toward HIV Providers, mean (SD)	42.7 (5.9)	44.6 (4.7)	3.81	.00

* N=502; N= 464, N=453

Table 2

Multivariate Linear Regression Model Predicting Percent ARV Adherence among HIV+ Substance Abusers in South Florida, (N=502)

	Unstandardized B (SE)	Standardized β	95% CI	P-value
FH Insecure	-0.062 (0.031)	-0.095	-0.122, -0.002	0.044
Depression Symptoms	-0.007 (0.008)	-0.068	-0.023, 0.008	0.359
Anxiety Symptoms	0.004 (0.007)	0.047	-0.009, 0.017	0.524
Trauma Symptoms	0.001 (0.004)	0.009	-0.008, 0.009	0.883
Dependence Symptoms	0.0002 (0.007)	0.001	-0.014, 0.014	0.981
HIV Treatment Access	0.003 (0.003)	0.036	-0.004, 0.009	0.417
Months in HIV Care	0.0004 (0.0002)	0.075	-0.00004, 0.001	0.076
ARV Diversion	-0.227 (0.027)	-0.351	-0.281, -0.173	<0.001