HIV Infection and Women's Sexual Functioning

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Objective: To compare sexual problems among HIV-positive and HIV-negative women and describe clinical and psychosocial factors associated with these problems.

Design: Data were collected during a study visit of the Women's Interagency HIV Study (WIHS). The WIHS studies the natural and treated history of HIV among women in the United States.

Methods: Between October 01, 2006, and March 30, 2007, 1805 women (1279 HIV positive and 526 HIV negative) completed a study visit that included administration of the Female Sexual Function Index. In addition, the visit included completion of standardized interviewer-administered surveys, physical and gynecological examinations, and blood sample collection.

Results: Women with HIV reported greater sexual problems than did those without HIV. Women also reported lower sexual function if they were classified as menopausal, had symptoms indicative of depression, or if they reported not being in a relationship. $CD4^+$ cell count was associated with Female Sexual Function Index scores, such that those with CD4 $\leq$199 cells per microliter reported lower functioning as compared with those whose cell count was 200 or higher.

Conclusions: Given research documenting relationships between self-reported sexual problems and both clinical diagnoses of sexual dysfunction and women's quality of life, greater attention to this issue as a potential component of women's overall HIV care is warranted.

Key Words: HIV, sexual behavior, sexual problems, women

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INTRODUCTION

Women with HIV are living longer and healthier lives with less comorbidity due to the effectiveness of antiretroviral treatments. Most women with HIV are sexually active after their diagnosis,[1,2] and have the opportunity to remain sexually active for more years due in part to these medical advances. Research on the topic of women's sexual behavior in the context of HIV infection has primarily taken place with the objective of assessing HIV transmission risk dynamics among women and their partners and has focused on condom use practices, determinants of sexual risk behavior, and unintended pregnancy.[3–6] Issues related to other aspects of sexual health, including satisfaction with sexual relationships among women living with HIV infection, have received relatively little attention.

Among women, sexual function problems are characterized by subjective reports of difficulties or limitations in sexual interest, desire, arousal, orgasm, and pain during sexual activity. A clinical diagnosis of female sexual dysfunction requires the presence of both a problem with sexual functioning and a subjective assessment of distress due to the problem. There is reason to believe that sexual problems occur more frequently among HIV-infected women than HIV-uninfected women. Chronic health conditions and diseases such as diabetes, cancer, vascular disease, arthritis, and hypertension are associated with impaired sexual functioning, as are certain drugs that are used to treat these conditions.[7,8] Factors associated with sexual problems or dysfunction in the general

population, such as mental health issues and substance abuse, are common among both men and women with HIV.[9,10] Further, concerns about HIV transmission, HIV treatment, including antiretroviral therapy, and treatment side effects may have deleterious effects on female sexual functioning.[11–13]

Most studies of sexual function among women with HIV describe a burden of sexual problems in this population,[14,15] although published information on the pathways influencing the relationships between HIV and women's sexual function has varied. For instance, although lower levels of sexual function among HIV+ women have been associated with greater severity of HIV-related symptoms[16] and with decreased adherence to antiretroviral therapy,[17] other studies have failed to detect associations between sexual function and biomarkers of disease course, including viral load, $CD4^+$ cell count,[18] and reported use of highly potent antiretroviral regimens.[11] Reports on the relationship between HIV-related body habitus changes and sexual function have also been equivocal, with one study finding no relationship[11] and another reporting lower function among those with altered body habitus.[17] These differences may be due in part to variations in the methods of measurement of sexual problems across these studies.

Information about the occurrence of problems with sexual function among HIV-infected women is needed to appropriately identify, address, and ideally prevent these problems from arising and to promote the sexual well being of women with HIV in general. In the current investigation, we describe self-reports of sexual problems among a large, nationally representative sample of women with and without HIV in the United States. We also examine psychosocial, clinical, and behavioral correlates of sexual problems among HIV-infected and HIV-uninfected women and also assess how HIV-specific parameters influence these issues among women with HIV infection.

METHODS

Participants

Data on sexual functioning was collected as part of the Women's Interagency HIV Study (WIHS). The WIHS is an ongoing prospective study of HIV infection among women in the United States. It is conducted in Bronx/Manhattan, NY; Brooklyn, NY; Washington, DC; San Francisco/Bay Area, CA; Los Angeles/Southern California/Hawaii and Chicago, IL.

Enrollment in WIHS occurred in 1994–1995 with an initial cohort of 2054 HIV-positive women and 569 HIV-negative women matched by age, race/ethnicity, recruitment site (including HIV testing sites, community outreach sites, drug rehabilitation centers, and hospital-based programs), and risk factors including history of injection drug use and number of sexual partners. In 2001–2002, an additional 737 HIV-positive women and 406 HIV-negative women were enrolled; these women were similar to the original cohort in terms of proportion of HIV-positive women and HIV-negative women falling into each of the matching categories. WIHS criteria for enrollment in 1994–1995 and 2001–2002 included HIV status confirmed by Western blot, an age of 13 years or older, and the ability to answer questions in English or Spanish. WIHS interviews are administered in English and in Spanish. Participants all provided written informed consent for study activities and completed a study visit every 6 months. These visits include completion of standardized, interviewer-administered surveys, physical and gynecological examinations, and collection of blood samples. For the current analysis, viral load and $CD4^+$ cell count were derived from specimens; all other variables were assessed via self-report. Additional details on the WIHS recruitment methods and baseline characteristics have been previously published.[19,20]

Of the 3766 women enrolled in WIHS, 2899 were alive at the study visit during which the cross-sectional sexual function measures were implemented (the visit occurring between October 1, 2006, and March 30, 2007), and 2095 (72%) women completed that study visit. Of the 2095 women who completed the visit, 188 completed an "abbreviated" study visit of select WIHS modules, which excluded the sexual function assessment. Of note, participants eligible for completing an abbreviated visit may face significant health or other contextual barriers to completing a full study visit that may be linked to impaired sexual function. An additional 102 women completed the study visit but did not complete all items on the sexual function assessment. Thus, eligible participants for the analysis include 1805 participants (1279 HIV-positive and 526 HIV-negative women).

Although the WIHS does not capture reasons for an abbreviated visit (eg, incarceration, hospitalization, increased burden of other commitments), we did examine differences between several variables among those completing the abbreviated (n = 188) and the full study visit (n = 1805). The likelihood of completing an abbreviated versus full visit did not differ as a function of HIV serostatus, age, baseline history of crack or heroin use, or, among HIV-positive women, detectable viral load (all $P > 0.05$). However, employed women were more likely to complete an abbreviated visit (12%) as compared with unemployed women (6%; $P < 0.05$). Questions on sexual activity were not asked as part of the abbreviated visit. We also compared those who completed the full study visit but who did (n = 1805) versus did not (n = 102) complete all of the Female Sexual Function Index (FSFI) items (n = 102). These groups did not differ at statistically significant levels as a function of HIV serostatus, age, or whether the respondent reported having been sexually active since the last study visit. Women were more likely to have missing data on the FSFI if they were unemployed (7%) versus employed (3%; $P < 0.01$), and if they reported at baseline a history of cocaine or heroin use (7%) versus no history (4%; $P < 0.01$). Among women with HIV infection, missing data were more frequent among women with a detectable viral load (7%) versus those with an undetectable viral load (4%; $P = .03$).

Procedures

The FSFI is a 19-item self-report survey, which includes subjective assessments along several domains of sexuality, including sexual arousal and desire, lubrication, orgasm, and pain during intercourse. For these different domains, questions assess the subjective frequency and severity of problems, and assessments of overall satisfaction or dissatisfaction in

different domains, including orgasm, overall sexual life, and within sexual relationships.[21] The scale has high internal consistency and strong associations with clinically diagnosed sexual function disorders, including sexual arousal disorder, female orgasmic disorder, hypoactive sexual desire disorder, female sexual desire disorder, and dyspareunia/vaginismus.[21–23] For domains in which no sexual activity is reported, FSFI scores fall between 0 and 1 (for those with the lowest levels of sexual activity and interest over the past 4 weeks) to 36, with higher scores indicating better sexual functioning. Sexual activity is broadly defined in the FSFI as including caressing, foreplay, masturbation and vaginal, or other sexual intercourse. Although most self-report modules in WIHS are interviewer administered, the FSFI was self-administered, with the study interviewer present to read items if necessary. This approach was chosen after review and approval of the FSFI by the WIHS Community Advisory Board and in response to a pilot of the survey and additional feedback from study personnel.

Symptoms of depression were assessed with the 20-item Center for Epidemiologic Studies Depression (CES-D) scale.[24] A CES-D score greater than 23 was used to identify participants with moderate to severe symptoms of depression.[25] The CES-D has high reliability in the population (Cronbach α = 0.93). Use of antidepressants was also recorded for the study visit. Both sexual behaviors and alcohol and drug use are ascertained for frequency since the last study visit (ie, over an approximately 6-month window). To assess recent drug use, participants were asked to report any use of marijuana, cocaine, crack, heroin, amphetamines or methamphetamine, hallucinogens, club drugs, or nonprescribed methadone or narcotics since the last study visit. Alcohol use since the last visit was defined as a report of consumption of any wine, beer, hard liquor, or other alcohol. Participants also completed questions on number and sex of sexual partners since the last study visit. A sex partner was defined as either a man or woman with whom the participant had engaged in vaginal, oral, or anal sex. Condom use consistency with male partners was defined as either no unprotected anal or vaginal intercourse (UAVI) or 1 or more episodes of UAVI since the last study visit.

Several factors associated with sexual function in the general population were also assessed. Menopausal status was defined by self-reported menstrual pattern, with postmenopausal women reporting no menses for the past 12 months, and others defined as nonmenopausal (including premenopausal, early perimenopausal, late perimenopausal). These definitions were developed by the World Health Organization and the Stages of Reproductive Aging Workshop (STRAW) working group[26,27] and have been used in other studies of menopause in women with HIV.[27–30] We were not able to classify several groups of women based on this definition, including women who were currently pregnant or lactating or who reported ever having had a hysterectomy or oophorectomy. We codified these women as "other/currently unknown" for this variable, and do not comment on their sexual functioning in this analysis, given the heterogeneity in regard to factors that may drive sexual problems. We also included self-reported use of hormone therapy (on therapy, not on therapy). Based on the history and physical examination, we also included information on body mass index (BMI $<$25 indicating not overweight, BMI $\geq$25 indicating overweight/obese), reported diabetes status, and whether or not participants were taking medication for seizures, or cardiovascular disease. Women with HIV completed additional questions regarding antiretroviral therapy and adherence and provided blood samples for measurement of HIV viral load. We defined highly active antiretroviral therapy (HAART) regimens based on Department of Health and Human Services (DHHS)/Kaiser Panel guidelines in place at the time of data collection.[31]

Antiretroviral therapy was categorized among HIV+ participants as (1) not on antiretroviral therapy, (2) on antiretroviral therapy but not HAART, or (3) on a HAART regimen. Among women on a HAART or non-HAART antiretroviral regimen, we assessed medication adherence by asking how often they had taken their medication as prescribed during the 6 months before the interview. These answers were categorized into $<$95% versus $\geq$95% adherence. In a meta-analysis examining the relationship of self-reported adherence to viral response among a pooled sample of more than 15,000 patients, the odds of detectable viral load were higher when self-reported adherence was set at a threshold of 95% or higher.[32] $CD4^+$ cell counts and HIV RNA measurements were measured at the study visit corresponding with the interview. Plasma HIV-1 RNA quantification was performed using the isothermal nucleic acid sequence–based amplification method in laboratories certified by the National Institutes of Health Virology Quality Assurance program, with a lower limit of detection set at 80 copies per milliliter. Indications of body fat loss symptoms were recorded by study personnel during the physical exam. All WIHS study procedures were reviewed by study investigators and by the WIHS Community Advisory Board and were approved by the Institutional Review Boards at each site.

Statistical Analysis

We first conducted a principal components analysis employing varimax rotation to assess the factor structure of the FSFI (n = 1805). This analysis was performed for the overall sample and for HIV-infected and HIV-uninfected women separately. Univariate analysis of variance was used to examine relationships between FSFI scores and posited sociodemographic (ie, age, racial/ethnic identification), psychosocial and behavioral (ie, relationship status, drug and alcohol use, sexual behavior), and clinical characteristics (ie, diabetes, BMI, depression symptoms, mental health medications, medications for seizures, blood pressure, and/or heart disease, hormone replacement therapy, menopause status). We next conducted factorial analysis of variance for all women in the sample (n = 1805), selecting variables for inclusion in the model that exhibited statistically significant univariate associations with the sexual functioning measure ($P <$ 0.05). We assessed whether there were statistically significant interactions with HIV infection status and each of the factors included in the model, controlling for age. We then utilized univariate analysis of variance to examine the relationships between sexual behavior (number of partnerships, consistency of condom use) and FSFI scores. Finally, univariate analysis of variance was used to assess the relationships between

antiretroviral regimen features, adherence to regimens, changes in body fat, $CD4^+$ cell count, and viral load among HIV-positive women on HAART (n = 846). Factorial analysis of variance examined the relationships between FSFI and CD4, viral load, and body fat changes, controlling for age. All analyses were conducted with SPSS version 17.0.

RESULTS

FSFI Scale Characteristics

Results of the principal components analysis for the scale indicated similar factor structures for both HIV-negative and HIV-positive women, and therefore, results of this analysis are reported for the combined sample. The original FSFI scale posited 6 factors (desire, arousal, lubrication, orgasm, dissatisfaction, and pain) that contribute to overall sexual function, and several analyses demonstrate correspondence between these factors and clinical diagnoses of sexual dysfunction such as pain, satisfaction, and sexual arousal.[21–23] However, our principal components analysis did not produce these 6 distinct factors; instead, most of the FSFI items in our sample loaded onto a single factor. That first factor, comprising 17 of the 19 items, explained 84% of the variance in sexual functioning and had an eigenvalue of 15.8. The second factor, comprising the 2 remaining items, accounted for 6.4% of the variance and had an eigenvalue of 1.2. We repeated this analysis separately for both HIV-positive and HIV-negative women and found a similar patterns of results. For this reason, and because previous validation studies were conducted on samples of higher income, HIV-negative women with relatively low proportions of participants of racial/ethnic minority status, we did not calculate factor scores for each of the original FSFI domains nor did we use the cutpoint that has been described in a previous article.[23] Instead, we computed total scores for the 19 items. These total scores ranged from 1.2 to 36.0 (median = 14, mean = 15, SD = 13, skewness = 0.17, Cronbach $\alpha = 0.99$).

Characteristics of the Study Population

Women with HIV had lower mean FSFI scores (mean = 13.8, SD = 12.7) than did women without HIV infection (mean = 18.0, SD = 13.2) in this sample ($P < 0.001$). Table 1 presents posited social, demographic, and clinical predictors of FSFI scores in the study population, along with associated FSFI scores, as a function of HIV status. Among both HIV-positive women and HIV-negative women, higher FSFI scores, indicating fewer sexual problems, were seen in women who were younger and who were married or living with a sexual partner. Similarly, HIV-positive women and HIV-negative women scored lower on the FSFI, indicating greater levels of sexual problems, if they were classified as having reached menopause, diabetic, if they reported symptoms indicative of depression and if they reported taking medication to treat mental health problems or for seizures, hypertension, or heart disease (all $P < 0.05$). For women without HIV infection, fewer sexual problems were reported among women whose BMI fell into the normal to underweight range and who were not on hormone therapy (all $P < 0.05$).

Factors Associated With Sexual Function

Results of a factorial analysis of variance describing relationships between FSFI and posited influential variables are reported in Table 2. For this model, we included variables which had statistically significant univariate relationships with FSFI among either HIV-positive women or HIV-negative women and also included HIV serostatus as a predictor. The final model excluded diabetes status, BMI category, hormone therapy, medication for seizures, hypertension, or heart disease, and medication for mental health conditions; these variables were not statistically significant after adjusting for other variables in the model and their exclusion did neither impact parameter estimates in the final model nor the overall variance accounted for in the model. The resulting model produced an adjusted $R^2 = 0.18$, with statistically significant main effects for age [F (3, 1652) = 23.8, $P < 0.001$], HIV status [F (1, 1652) = 15.3, $P < 0.001$], relationship status [F (1, 1652) = 55.3, $P < 0.001$], menopausal stage [F (2, 1652) = 12.0, $P < 0.001$], and depressive symptoms [F (1, 1652) = 36.8, $P < 0.001$]. There were no statistically significant interactions detected between HIV status and any of the other variables in the model (all $P > 0.05$).

Sexual Behavior and Sexual Function

Thirty-two percent of the study population reported having had no vaginal, oral, or anal sex with a male or female sexual partner since the last study visit (23% HIV−, 35% HIV+), 60% reported having had 1 partner (61% HIV−, 59% HIV+), and 8% reported having had 2 or more partners (15% HIV−, 6% HIV+). Among the HIV-positive women who reported 1 or more partners (n = 829), 774 reported at least 1 male partner, 40 reported at least 1 female partner, and 15 reported both male and female partners. Among the HIV-negative women who reported 1 or more partners (n = 404), 361 reported at least 1 male partner, 36 reported at least 1 female partner, and 7 reported both male and female partners. As described earlier, the FSFI defines sexual behavior broadly (eg, including caressing, masturbation) and attributes the lowest levels of sexual function to those reporting no recent sexual activity.[33] Therefore, those reporting no vaginal, oral, or anal sex are likely to have lower FSFI scores but may not have lower scores if the individual engages in behaviors that confer low HIV transmission risk and does not report problems with engaging in these activities. A general linear model including age, HIV serostatus, and number of sexual partners (0, 1, or 2+) and a product term for the latter 2 variables revealed a significant interaction between HIV serostatus and number of male and female sexual partners on FSFI scores, F (2, 1796) = 6.83, $P < 0.001$. Among HIV-negative women, FSFI increased as number of partners increased from 0 (mean = 2.7, SD = 2.7) to 1 (mean = 22.7, SD = 11.9) but did not differ as partners increased from 1 to 2 or more (mean = 22.7, SD = 9.6). Among HIV+ women, FSFI increased as number of partners increased from 0 (mean = 2.9, SD = 4.6) to 1 (mean = 19.2, SD = 11.9) to 2 or more (mean = 23.8, SD = 10.1).

In terms of UAVI with a male partner, 22% of HIV-positive women reported this behavior at least once since the last study visit, compared with 55.5% of HIV-negative women. Among the 1233 women who reported 1 or more sexual

TABLE 1. Univariate Associations With FSFI Scores Among Participants in the WIHS (n = 1805), Stratified by HIV Status

	HIV+			HIV−		
	Mean, SD	n	*P*	Mean, SD	n	*P*
Age		1279			526	
20–29	19.6, 12.7	71	<0.001	23.1, 11.3	97	<0.001
30–39	17.1, 12.5	352		22.0, 12.0	159	
40–49	14.2, 12.8	545		16.0, 13.4	181	
50+	7.8, 10.3	311		9.7, 11.6	89	
Race and ethnicity		1279			526	
White	13.7, 12.8	168	0.95	16.4, 13.3	47	0.17
Black	13.7, 12.7	718		18.1, 13.1	317	
Hispanic	13.7, 12.6	355		17.4, 13.4	139	
Other	14.9, 13.1	38		23.5, 12.2	23	
Married or living with a partner		1278			526	
Yes	18.2, 12.4	394	<0.001	20.7, 12.8	169	<0.001
No	11.8, 12.4	884		16.8, 13.2	357	
Alcohol use since last visit		1276			523	
No	13.8, 12.7	741	0.84	17.4, 13.3	297	0.21
Yes	13.6, 12.7	535		18.9, 13.0	226	
Substance use since last visit		1275			523	
No	13.8, 12.8	989	0.57	17.6, 13.1	403	0.14
Yes	13.4, 12.5	286		19.6, 13.3	120	
Diabetes		1220	0.009		506	0.002
No diabetes	14.1, 12.7	977		18.9, 12.9	407	
Diabetes	11.7, 12.3	243		14.4, 13.4	99	
BMI		1244			507	
Underweight/normal	13.3, 12.6	419	0.27	20.2, 12.7	124	0.04
Overweight/obese	14.1, 12.8	825		17.4, 13.3	383	
On medication for seizures, blood pressure, heart disease		1279			526	
No	14.7, 12.8	932	<0.001	19.5, 13.0	425	<0.001
Yes	11.1, 12.1	347		12.0, 12.1	101	
On medication for depression/mental health		1279			526	
No	14.5, 12.8	970	<0.001	18.8, 13.1	446	0.003
Yes	11.5, 12.3	309		14.0, 13.1	80	
On hormone therapy		1278			526	
No	13.9, 12.7	1224	0.12	18.3, 13.1	509	0.008
Yes	11.1, 12.0	54		9.7, 12.0	17	
Menopause status		1153			514	
Other/not classified	12.2, 12.5	331	<0.001	14.5, 13.3	108	<0.001
Not menopausal	16.5, 12.9	611		20.5, 12.6	351	
Menopausal	7.8, 9.9	211		10.9, 12.0	55	
Symptoms of depression		1276			524	
Lower/CESD le 23	14.9, 12.9	1020	<0.001	18.9, 13.2	424	0.001
Higher/CESD gt 23	9.2, 10.8	256		14.1, 12.5	100	

partner since the last study visit, 579 (47%) reported at least 1 episode of unprotected anal or vaginal sex (72% for HIV-negative, 35% for HIV-positive women, $P < 0.001$). Among women with 1 or more partners, those who reported no unprotected sex had lower sexual function scores (mean = 19.0, SD = 12.2) than did women who reported 1 or more unprotected episodes (mean = 22.4, SD = 11.0, $P < 0.001$). No statistically significant interactions were detected between HIV status and UAVI on FSFI scores, after controlling for age ($P = 0.14$).

HIV-Specific Parameters and Sexual Function

Of women with HIV infection, 846 (66%) were on HAART, 41 (3%) were on an HIV antiretroviral regimen that was not classified as HAART, and 392 (31%) were not on antiretroviral therapy at the time of the study visit. FSFI scores did not differ by ARV status at the time of the visit [F (2, 1276) = 0.81, $P = .44$]. Among women on antiretroviral therapy, 77% reported adherence levels of at least 95%; adherence was not related to FSFI scores ($P = 0.20$). Among women on HAART,

TABLE 2. Predictors of FSFI Scores Among HIV-Negative Women and HIV-Positive Women (n = 1661).

	B	Standard Error	*t*	*P*	Adjusted 95% CI	
Intercept	1.76	0.98	1.80	0.07	−0.16	3.68
HIV status						
HIV negative	2.53	0.65	3.91	<0.001	1.26	3.80
HIV positive	1.00	—	—	—	—	—
Age						
20–29	9.15	1.25	7.30	<0.001	6.69	11.61
30–39	7.10	0.96	7.40	<0.001	5.21	8.98
40–49	4.33	0.85	5.12	<0.001	2.67	5.98
50+	1.00	—	—	—	—	—
Married or living with a partner						
Yes	4.79	0.64	7.43	<0.001	3.53	6.05
No	1.00	—	—	—	—	—
Menopause status						
Other/not classified	1.88	0.96	1.97	0.05	0.01	3.76
Not menopausal	4.42	0.97	4.57	<0.001	2.52	6.32
Postmenopausal	1.00	—	—	—	—	—
Symptoms of depression						
Lower/CESD le 23	4.43	0.73	6.07	<0.001	3.00	5.86
Higher/CESD gt 23	1.00	—	—	—	—	—

62% were on a regimen that included at least 1 protease inhibitor (PI), and 36% women were on a regimen that included a nonnucleoside reverse transcriptase inhibitor. All women on HAART reported that their regimen included an nucleoside reverse transcriptase inhibitor. We examined whether women with a PI-containing regimen differed from those with regimens that did not include at least 1 PI and found no difference in FSFI scores ($P = 0.44$). There were also no differences in FSFI for those regimens containing at least 1 nonnucleoside reverse transcriptase inhibitor ($P = 0.97$).

Forty-five percent of all women with HIV infection had a detectable viral load; this was not associated with FSFI scores ($P = 0.29$). Sixteen percent of all HIV-positive participants exhibited evidence of body habitus changes. In univariate analysis, those with body habitus changes had lower FSFI scores (mean = 11.4, SD = 12.2) than did those with no changes (mean = 14.2, SD = 12.8, $P = 0.003$). Fourteen percent of women were classified as having CD4 ≤199 cells per microliter, 41% between 200 and 499 cells per microliter, and 45% ≥500 cells per microliter. $CD4^+$ cell count was associated with FSFI scores ($P = 0.005$); post hoc comparisons revealed that those with CD4 ≤199 cells per microliter had lower scores (mean = 11.0, SD = 11.8) as compared with those whose count fell between 200 and 499 cells per microliter (mean = 13.9, SD = 12.7, $P = 0.019$) or greater than or equal to 500 cells per microliter (mean = 14.5, SD = 13.0, $P = 0.004$); the 2 higher groups did not differ from one another ($P = 0.77$). Factorial analysis of variance assessed the relationship between FSFI and body fat loss, $CD4^+$ cell count, and age. This model revealed that $CD4^+$ cell count remained statistically significant, F (2, 1220) = 4.1, $P = 0.02$, as did age, F (3, 1220), = 35.0, $P < 0.001$, but that body fat loss was not related to FSFI after controlling for those variables, F (1, 1220) = 0.3, $P = .60$).

DISCUSSION

Our analysis reveals that the burden of sexual problems is significantly higher among women with HIV infection compared with HIV-uninfected women. Subjective reports of sexual problems are common among women in the United States. Data from the 1992 National Health and Social Life Survey, the most recent nationally representative study on sexuality among younger adults in the United States, suggest that among sexually active women aged 18–59, over 40% report symptoms indicative of sexual problems over a 12-month period.[34] As would be expected from past research on sexual functioning in women, sexual function scores in the WIHS cohort were associated with age, menopause, symptoms of depression, and relationship status. However, the inclusion of these factors did not mitigate the influence of HIV infection on impaired sexual function scores. In addition, HIV did not influence the relationships between these factors and sexual function scores.

Although we confirmed univariate associations between several previously published correlates of sexual function among HIV-infected women, including BMI, therapeutic regimens for mental health, therapeutic regimens for seizures, blood pressure or heart disease, hormone therapy, and diabetes, these relationships were not sustained in multivariate analysis. In addition, although previous research has described the impact of chronic drug and alcohol use on impaired sexual function,[35] we did not find a relationship between sexual problems and alcohol or drug use. We note, however, that our measures of alcohol and other substance use only estimate whether 1 or more instances of use were reported since the last study visit; these measures do not account for either the role of drug and alcohol abuse and dependence on sexual problems or the role of drug or alcohol use during sexual activity.

In addition, although CD4 cell count was associated with sexual function in this study, we did not replicate previous findings on factors associated with sexual problems in persons with HIV. We did not, for instance, detect statistically significant associations between sexual problems and being on HIV antiretroviral therapy, being on certain classes of antiretroviral therapy (eg, a PI-containing regimen), or HIV antiretroviral therapy adherence. Given that little investigation in this area has been conducted in populations consisting primarily of women, further research is needed to help clarify these inconsistent findings.

The role of sexual function and HIV or sexually transmitted infection transmission risk behaviors has not been clearly established in the literature. In this analysis, we found a positive correlation between reporting fewer sexual problems over the past 4 weeks and reporting 1 or more episodes of unprotected anal and/or vaginal sex with male sexual partners since the last study visit. We cannot make causal assumptions given the cross-sectional nature of the analysis and the different time parameters for assessment of sexual behavior and sexual function. However, we believe that this finding warrants further examination. For instance, if additional research

demonstrates a causal link between increased sexual function and transmission risk behavior, then HIV or sexually transmitted infection prevention approaches may need to be incorporated as part of assessment and treatment of sexual problems. On the other hand, this relationship could simply reflect a measurement artifact, whereby those in sexual relationships tend to score higher on the FSFI than those with no sexual relationships. Those who were not in sexual relationships were scored as having no unprotected anal or vaginal sex, which may account for some of this finding.

Our data did not allow us to examine the relationships between FSFI and sexual risk behavior in different types of relationships, although we did report higher function among those living with a sexual partner or married. The greater level of perceived intimacy that may for instance be present in more established (versus casual) relationships may be linked to increased risk for unprotected sex, given that condom use is less frequent in relationships defined as main or primary, versus those defined by participants as being more casual in nature.[36] Although articles describing patterns of partnerships and transmission risk behaviors with HIV concordant and discordant partners in the WIHS have been published previously,[37,38] the self-report instrument at the time of the FSFI administration did not include measures of condom use or partner serostatus on a partner-specific level. Therefore, we were unable to disentangle these relationships.

We include a note of caution in the interpretation and analysis of scales such as the FSFI in the assessment of sexual function among women living with HIV/AIDS. The FSFI is designed to be utilized for both sexually and nonsexually active women. However, many of the items are scored such that those who report no sexual activity, defined as any sexual activity or sexual intercourse in the past 4 weeks, are assigned a numeric value of "zero," indicating the lowest level of social, psychological, and physical dimensions of sexual functioning. Although sexual activity is defined broadly in the inventory to include activities that occur with or without physical contact with a sexual partner (eg, masturbation, foreplay), we believe that this measure may over-categorize some women as low functioning. For instance, data from the HIV Cost Services Utilization Study reveal that approximately 50% of HIV-positive respondents reporting no anal, vaginal, or oral sex in the prior 6 months said that their abstinence was deliberate.[39] In an analysis of men and women with HIV who were homeless or had unstable housing, nearly 20% reported intentional abstinence in the past 90 days. In this analysis, common reasons cited for abstinence included unavailability of a sex partner and concern about transmitting HIV.[40] Thus, it could be assumed that at least for some respondents, lack of sexual activity may reflect a temporary unavailability of sexual partners at any given time or may be based on intentional abstinence for both HIV+ women and women who are at risk for infection. It is unknown whether sexual dysfunction may be less pronounced when intended abstinence explains a lack of sexual activity. Our study did not assess whether a lack of sexual behavior reflected a lack of available partners, a decision to abstain from sex, or some other combination of factors. However, this would be important to examine as a component of furthering this area of study.

We believe that our study contributed to the literature on sexual function in HIV by using a commonly used and widely accepted tool for the assessment of self-reported sexual problems and by comparing women with HIV to a seronegative cohort. However, we noted some differences in the psychometric properties of the scale in this sample as compared with previous reports. For instance, we note that the FSFI factor structure previously reported by Rosen et al[21] was not reproduced within our sample using the same methods of analysis. In addition, the very high internal consistency suggests that there may be some redundancy that could be addressed in future studies with HIV-infected samples. Thus, some refinements of measurement of the construct of sexual function among HIV-positive women may be useful to help further delineate the extent and nature of these issues.

Although we did not have data available on overall subjective assessments of HIV-related quality of life for the study visit in which we administered the FSFI, we did include some markers of overall health in our analysis. For instance, women with HIV who had $CD4^+$ cell counts of less than 200, which is AIDS defining, had significantly lower FSFI scores than did those with higher cell counts. The causal nature of sexual difficulties on quality of life is unclear, given that these variables can plausibly be argued to be bidirectional in influence. However, there seems to be a strong correlation between impaired sexual function and both emotional and physical satisfaction in relationships and with indices of general life satisfaction and happiness.[34]

There is continued need for additional investigation into the area of sexual function among HIV-positive women. This would include an increased understanding of sexual function measures in the context of infectious diseases such as HIV/AIDS, particularly in regard to the role of intentional abstinence. Although definitive conclusion awaits replication of our findings in other cohorts, our study shows a clear link between HIV infection and sexual problems among women. We propose, therefore, that there is a role for assessment of sexual problems in the overall care of women with HIV infection, particularly those classified as having AIDS. Additional areas of investigation would include methods for accurate and feasibly implemented assessment of sexual problems in the context of HIV care and an examination of intervention approaches that could be effectively and reasonably implemented in this or similar settings.

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