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Body Mass Index, Depression and Sexual Transmission Risk Behaviors Among HIV-Positive MSM

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Abstract

Depression has been shown to be a risk factor for serodiscordant unprotected anal intercourse (SDUAI) in some studies, but not others. Body mass index (BMI) has recently been associated with SDUAI; however, to date, no published study has investigated the interactive effect of depression and BMI on SDUAI. The current study assessed the association between depression, BMI, and SDUAI among HIV-positive MSM. Participants were 430 HIV-positive MSM recruited in a Boston community health center where they received primary care. Participants completed audio computer-assisted self interview (ACASI) measures. Objective height and weight and other clinical variables were accessed through participants' electronic medical records. Depression was positively associated with SDUAI. This association was significantly moderated by BMI. Elevated levels of depression were only associated with SDUAI for underweight participants. These findings suggest that underweight, depressed HIV-positive MSM may be particularly likely to engage in SDUAI.

Keywords

HIV/AIDS; BMI; Depression; MSM; Sexual transmission risk

Introduction

Despite being several decades into the HIV/AIDS epidemic, with widespread public awareness of male to male sex as a major risk factor for HIV transmission, men who have

sex with men (MSM) continue to constitute the largest number of individuals living with HIV in the United States [1]. Recent data reveal that in major U.S. cities one in five MSM are living with HIV [2]. Although MSM comprise between 2 and 6% of the population [3–5], they account for 53% of all new HIV infections in the U.S. [1]. Given these dramatic statistics, understanding the association between risk factors for HIV transmission among MSM remains crucial in developing empirically-guided prevention interventions.

HIV-positive individuals experience elevated rates of depression, with some reports noting a prevalence rate of 36%, compared to 7.6% among a representative sample of HIV-negative individuals [6]. Depression not only creates quality of life difficulties for individuals living with HIV, its presence also represents a possible risk factor in the sexual transmission of HIV [7–10]. A meta-analysis [11], revealed a very modest, non-significant association ($r = .04$) between depression and sexual risk behaviors collapsed across both HIV-positive and negative individuals. However, it should be noted that there was significant heterogeneity between the various effect sizes, suggesting the presence of unaccounted moderator variables [11, 12]; it is quite possible that depression is related to sexual risk behaviors for some groups of individuals but not others.

Body mass index (BMI) may represent a plausible moderator that could help to elucidate the association between depression and sexual risk among MSM. Concerns about body weight and body fat are highly prevalent among MSM [13–15]. Increased rates of overweight and obesity have been recently documented in HIV-positive samples [16], although, there is also a sizeable minority of HIV-positive patients who report significant weight loss as a result of disease progression and/or side effects of treatment [17]. Several recent studies have examined the association between BMI and sexual risk behaviors among MSM [18–20]. Kraft et al. [20] found that non-obese HIV-negative MSM had 3.6 greater odds of engaging in unsafe sex as compared to obese MSM. However, because the BMI variable was dichotomized as obese versus non-obese, it is unknown if there were differences between non-obese (i.e., underweight, normal, overweight) men in regard to sexual risk. Similarly, Allensworth-Davies et al. [19] found significant group differences in BMI when examining unprotected anal sex as an outcome variable among a sample of HIV-negative MSM. Results indicated that reporting weight in the normal range was associated with increased risk for unprotected anal intercourse compared with either underweight or overweight/obese MSM. A notable limitation of this study is that BMI groups were operationalized as a function of participants' self-reported perception of their body size, as opposed to analyzing participants' objective height and weight.

In contrast with these studies Moskowitz and Seal [18] reported very modest negative associations between BMI and reported condom use in the past year among MSM using the internet, such that as BMI increased, condom use decreased. However, as these associations were reported in multiple regression models with skewed distributions, that controlled for number of partners (a variable known to differ between obese and non-obese MSM), and excluded those who reported no anal intercourse in the past year (a legitimate risk reduction strategy), the interpretation of these findings is unclear. The majority of the few studies in this area suggest that having BMI in the normal range may be associated with increased risk for unprotected anal intercourse compared to overweight or obese MSM. However, the lack of available research and differing methodologies across studies render these conclusions tenuous at best. In addition, BMI is implicated in advancing HIV disease, body image concerns, depression, and other mental health issues, many of which have yet to be examined in the context of sexual risk.

Given the high prevalence of HIV in MSM, the effects of HIV on BMI, the potential association of BMI to sexual risk, as well as the hypothesis that the association of depression

to sexual risk may be moderated by other variables, we sought to examine BMI and depression together in assessing HIV transmission risk behaviors in HIV-positive MSM.

Methods

Participants and Procedure

The sample consisted of 430 HIV-positive MSM who were screened for participation in a secondary HIV prevention intervention [21]. Participants were recruited from the largest ambulatory HIV primary care facility in New England, based in Boston, which has traditionally served sexual minority populations [22]. Eligibility for the current study included (1) having an HIV diagnosis for at least 3 months; (2) being over age 18; (3) self-identifying as MSM; and (4) receiving primary HIV care at the community health center.

During the screening/baseline visit, trained research assistants explained study parameters and obtained informed consent, including permission to extract information from electronic medical records. Each participant then completed an audio-computer assisted self-interviewing (ACASI) assessment that addressed demographic data, HIV history, psychopathology, and sexual risk behaviors. HIV-related biomarkers (e.g., CD4 T-cell count and viral load) as well as height and weight (for calculations of BMI) were extracted from participants' electronic medical records. Participants received monetary compensation for their time and effort. The Fenway Health Institutional Review Board approved of all study procedures.

Measures

Demographics—Demographic information included a continuous measure of age, and categorical measures of education (less than a college degree, college degree, graduate degree), annual income (\$20,000, \$20,001–\$40,000, \$40,001–\$80,000, >\$80,000), and race and ethnicity (White, African American/Black, Latino/Hispanic, other). Additionally, participants were asked if they were in a primary relationship with at least one male sex partner during the last 3 months, defined as someone with whom they lived with or seen a lot, and to whom they felt a special emotional commitment.

Sexual Risk—As part of the comprehensive baseline assessment, participants were asked a series of questions regarding their sexual practices, following standards from studies of HIV sexual transmission risk behaviors among MSM (e.g., [23]). Participants who reported engaging in unprotected insertive or receptive anal intercourse with partners of HIV-negative or unknown status (SDUAI) within the past 3 months were considered to have engaged in transmission risk behavior (i.e., the main outcome of this study was a dichotomized SDUAI variable).

Depressive Symptoms—Symptoms of depression were measured using the continuous total score from the 9-item Depression Severity Scale of the Patient Health Questionnaire (PHQ; [24]), a self-report instrument designed to detect symptoms of common mental health disorders in primary care settings through diagnostic and symptom severity assessments.

Substance Use—As part of the psychosocial assessment, participants were asked if they had sniffed, snorted, smoked, swallowed, or injected any illicit drugs within the past 3 months. If participants answered affirmatively to this question, they were asked to identify their specific drugs of use, including crystal meth (methamphetamines) and this item was then dichotomized to distinguish those reporting use in the past 3 months from those reporting no use.

Body Mass Index—Body mass index (BMI) is a well-recognized, frequently used measure of one's adiposity (e.g., [25]). For the purposes of the current study, BMI was accessed from participants' electronic medical record (i.e., height and weight were objectively measured at participants' most recent HIV-related physician visit to the completion of self-report measures) and was calculated as $(703 \times \text{weight in pounds})/(\text{height in inches}^2)$. BMI was categorized into four groups which are recognized by the National Institutes of Health (NIH) as discrete entities of adiposity. The following BMI cutoffs were used, per the NIH recommendations: underweight <18.5 ; normal weight $18.5-24.9$; overweight $25-29.9$; and obese ≥ 30 [26].

Results

Demographic, Psychosocial, and Behavioral Characteristics

Demographic characteristics are presented in Table 1. Participants' average age was 41.9 years ($SD = 7.9$), with the majority ($n = 323$; 75.1%) being of non-Hispanic White ethnicity. Slightly over half ($n = 218$; 50.6%) had a Bachelor's degree or higher, and over 1/3 ($n = 154$; 35.8%) reported an income of \$20,000 or less/year. See Table 2 for means, standard deviations, and correlations for all study variables.

BMI Group Differences on Depression

A one-way analysis of covariance (ANCOVA) was conducted to assess group differences in BMI on the continuous total score of depression. The variables of participant CD4 T-cell count, viral load (log 10), age, ethnicity, and education, as well as crystal methamphetamine use (given the association between crystal meth and depression; [27]) were included in this analysis as covariates. Results revealed a significant main effect of BMI, $F(3, 412) = 3.28$, $P = .02$, partial $\eta^2 = .023$. Planned least significant difference (LSD) contrasts indicated that underweight participants reported significantly higher levels of depression compared to all other BMI groups, who did not significantly differ from each other (see Fig. 1).

Moderation Analyses

Results indicated that BMI moderated the association between depression and SDUAI. To test this, hierarchical logistical regression was employed. In Step 1, the covariates of participant CD4 T-cell count, viral load (log 10), age, education, and ethnicity, as well as crystal methamphetamine use were entered into the model. In Step 2, the predictor variables of depression and BMI were entered. Finally, in Step 3, the interaction term depression by BMI was entered into the regression model. Results indicated that elevated levels of depression were associated with SDUAI (Odds Ratio = 1.43, $\beta = .36$, $SE = .15$, $z = 2.37$, $P = .02$). However, BMI was not found to be significantly associated with SDUAI (Odds Ratio = 1.25, $\beta = .23$, $SE = .18$, $z = 1.27$, $P = .20$). When the product variable depression by BMI was entered into the model, a significant association was noted with SDUAI (Odds Ratio = .86, $\beta = -.14$, $SE = .06$, $z = -2.32$, $P = .02$).

To probe the significant depression by BMI interaction, Hayes and Matthes [28] MODPROBE script for SPSS was utilized. In doing so, the moderator variable (BMI) was set at each of its four levels (i.e., underweight, normal weight, overweight, and obese). Results indicated that elevated levels of depression were associated with SDUAI only for participants who were underweight (Odds Ratio = 1.25, $\beta = .22$, $SE = .09$, $z = 2.28$, $P = .02$). See Table 3 for more details.

Discussion

The main finding from the current study indicated that BMI moderated the association between depression and SDUAI in HIV-positive MSM. Accordingly, elevated levels of depression were associated with SDUAI only among underweight men. The main effect of depression was significantly associated with SDUAI, whereas BMI, in isolation, was not. Further analyses revealed that underweight participants reported higher levels of depression than their normal, overweight, and obese counterparts. However, there were no BMI group differences in SDUAI.

Regarding the main finding, depression was only found to be associated with SDUAI for underweight MSM. It is possible that underweight MSM who experience depression seek out sexual partners to modulate their negative affect and to feel sexually desired. This is contrasted with normal, overweight, and obese MSM, who may utilize other coping mechanisms when experiencing negative affect, such as alcohol or substance use, or binge eating.

In this sample, BMI status was not significantly associated with SDUAI. Past studies with HIV-negative MSM have found that BMI in the normal range was associated with increased sexual risk for HIV [19, 20]. The current findings further qualify these results and suggest that in the presence of significant depressive symptoms underweight BMI may represent a pathway to sexual transmission risk for HIV-positive MSM. Future research could usefully examine more nuanced models of mediators of these associations to understand more fully the mechanisms that drive the association between BMI and sexual risk taking.

Additional analyses found higher levels of depression among underweight compared to normal, overweight, and obese participants. Here too, past research on depression and BMI has yielded mixed results. Some studies have noted an inverse relation between BMI and depression among men, in that underweight men report the highest levels of depression (e.g., [29]). However, meta-analytic research has found no significant association between BMI and depression among men (e.g., [30]). While still other longitudinal (e.g., [31]) work has revealed positive associations between BMI and depression. The confluence of mixed and contradicting results suggest that researchers should account for moderator variables that may be obscuring their findings.

Among HIV-positive MSM, Halkitis et al. [32] noted a great deal of focus on muscularity, as it is an important marker of masculinity, sexual attractiveness, and health within this population [33]. Thus, underweight participants in the current study may have had elevated levels of depression as a result of not living up to the muscular ideal of gay culture. It is also possible that even with the evolving nature of current HAART regimens, past stereotypes regarding wasting syndrome and HIV/AIDS remain present in the minds of HIV-positive MSM, and thus, men who are underweight may be particularly distressed by concerns of being labeled as HIV-positive due to their appearance.

Despite the novel findings the current study yielded, it is not without limitations. Of note, the use of BMI limits some interpretations of the data. Because BMI is a function of height and weight, it is impossible to disentangle ones' adiposity from muscularity with this index. Thus, participants who were grouped into the obese group (BMI ≥ 30), may not have necessarily been "obese" in regard to their level of adiposity, but rather, because they possessed a significantly muscular body. Further, the cross-sectional nature of the current study precludes temporal inferences of the study variables. Future research should incorporate body-related variables, depression, and sexual risk behaviors within a longitudinal framework to more validly address temporal prediction.

In sum, the current study revealed that BMI moderated the association between depression and SDUAI among HIV-positive MSM. Specifically, elevated levels of depression were associated with SDUAI only for underweight men. These results suggest that HIV prevention interventions should consider body-related variables when addressing mood and sexual risk reduction components.

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Fig. 1.

One-way analysis of covariance comparing BMI groups on depression, controlling for participant CD4 T-cell count, viral load (log 10), age, education, ethnicity, and crystal meth use, $F(3, 412) = 4.02$, $P = .008$, partial $\eta^2 = .028$. *The underweight group reported significantly greater levels of depression compared to the remaining three BMI groups, which did not differ between each other

Table 1

Demographic variables

Variable	Mean	Standard deviation
Age	41.9	7.9
CD4 T-cell	518.9	298.4
Viral Load (Log10)	2.66	1.15

Frequencies (Percent)	
Income	
20,000 or less	154 (35.8%)
20,001 to 60,000	160 (37.2%)
60,001 or more	110 (25.6%)
Education	
High school degree or less	64 (14.8%)
Some college	148 (34.4%)
College graduate	115 (26.7%)
Some graduate school or more	103 (23.9%)
Ethnicity and race	
Black/African American	48 (11.2%)
Hispanic/Latino	40 (9.3%)
White/Caucasian	323 (75.1%)
American Indian/Alaskan Native	8 (1.9%)
Asian/Asian American	4 (0.9%)
Other	7 (1.6%)

For the income variable, $N = 424$, as three participants refused to answer this item, and there were missing data for three additional participants

Table 2

Means, standard deviations, frequencies, and correlations between study variables

Variable	Mean/Frequency	Standard deviation	Dep	BMI	Crystal	SDUAI
Dep	1.7	2.5	–	–.06	.13**	.05
BMI	25.3	3.9		–	–.09	–.05
Crystal	Yes: 88 (20.5%) No: 342 (79.5%)				–	.32**
SDUAI	Yes: 155 (36%) No: 275 (64%)					–

Dep depression, BMI body mass index, Crystal crystal meth, SDUAI serodiscordant unprotected anal intercourse

**
 $P < .01$

Table 3

BMI, depression, interaction, and simple slopes in associations with sexual transmission risk behaviors

Variable	Odds ratio	β	SE	z	p
Dep	1.43	.36	.15	2.4	.02
BMI	1.3	.23	.18	1.3	.20
Dep*BMI	.86	-.14	.06	-2.3	.02
Dep*BMI (Under weight)	1.24	.22	.09	2.3	.02
Dep*BMI (Normal weight)	1.08	.08	.05	1.5	.13
Dep*BMI (Over weight)	.94	-.06	.06	-1.1	.27
Dep*BMI (Obese)	.81	-.20	.10	-1.9	.06

Dep depression, *BMI* body mass index