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The Skinny on Sexual Risk: The Effects of BMI on STI Incidence and Risk

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Abstract

Few studies examine the influence of body mass index (BMI) on sexual risk. The purpose of this study was to determine whether BMI among 704 young mothers (ages 14–25) related to STI incidence and sexual risk. We examined the effect of BMI groups (normal weight, overweight, and obese) at 6 months postpartum on STI incidence and risky sex (e.g., unprotected sex, multiple partners, risky and casual partner) at 12 months post-partum. At 6 months postpartum, 31% of participants were overweight and 40% were obese. Overweight women were more likely to have an STI (OR = 1.79, 95% CI = 1.11–2.89, $P < .05$) and a risky partner (OR = 1.64, 95% CI = 1.01–2.08, $P < .05$) at 12 months postpartum compared to normal weight women. However, obese women were less likely to have an STI than normal weight women (OR = .57, 95% CI = .34–.96, $P < .01$). BMI related to STI incidence and sexual risk behavior. Integrated approaches to weight loss and sexual risk prevention should be explored.

Keywords

Sexual risk; BMI

Introduction

Obesity and sexual risk are two of the most prevalent public health concerns among young adults in the United States today. Over one-third of the U.S. population is obese [1]. HIV

and other sexually transmitted infections (STIs) are also prevalent among adolescents. Approximately 40% of new HIV cases are among people under the age of 25 [2] and the incidences of Chlamydia and gonorrhea are highest among women and men between the ages of 15 and 24 [3]. Researchers have identified multiple risk factors that are common to both issues, including issues of sexuality (e.g., sexual satisfaction and frequency) and psychosocial risks (e.g., depression and self-esteem) [4–12]. Despite the prevalence of obesity and sexual risk among young adults, little research has explored how these issues intertwine.

Obesity and Sexual Risk among Young Mothers

Adolescents mothers are at increased risk for overweight and obesity because their bodies continue to grow and develop while pregnant, a fact that is associated with increased weight gain and fat storage [13–15]. Young mothers are also at an increased risk for HIV/STIs. A systematic review of STI acquisition and condom use of mothering adolescents showed: 14–39% tested STI positive 6–10 months postpartum, and adolescent mothers were twice as likely to have an STI compared to nulliparous sexually active peers [16], highlighting the high-risk behaviors of adolescents after pregnancy.

Posited Links between Obesity and Sexual Risk

There is a paucity of research that examines the association between weight status, as measured by body mass index (BMI), and sexual risk. Of the limited evidence assessing this relationship, two theories have been suggested; the first suggesting that the association between BMI and sexual risk is mediated by psychosocial risk factors, and the second suggesting that BMI influences sexual risk directly through its influence on sexual frequency and number of partners (Fig. 1).

In support of the first theory, direct associations have been consistently demonstrated between obesity and depression, anxiety, and low self-esteem [4, 5, 7, 8]. These links have been extended to parenting women. In a longitudinal assessment, BMI was significantly correlated with both depression and anxiety up to 14 months postpartum [17]. Research has also linked depression, low self-esteem, and anxiety to high risk sexual behavior (e.g., early sexual initiation, unprotected sex) [8, 9, 11]. Although some literature has failed to make this connection or is limited by the use of cross-sectional analyses, prospective studies have found that psychological distress was directly associated with high risk sexual behavior among samples of adolescents [10, 12]. Furthermore, one study found that individuals with greater BMI and unhealthy weight control behaviors were 2–3 times more likely to have a casual sex partner or be intoxicated at last sexual intercourse [18]. It has been postulated that increased sexual risk behaviors among overweight or obese adolescents may be linked to the desire to feel more positively about themselves and their bodies by proving that they can attract a sexual partner [19]. It is also possible that the psychosocial effects of obesity, including increased depression and social problems, may affect the ability to form positive romantic relationships and negotiate safe sex practices, resulting in increased sexual risk.

The second body of literature suggests that BMI has a direct influence on sexual risk by influencing sexual frequency and number of partners (depicted as a dashed line in Fig. 1). This path suggests that individuals with lower BMI have more sex (in terms of frequency and partners) which leads to higher risk. Kolotkin and colleagues [20] found that among a sample of obese individuals, extreme obesity related to less sexual enjoyment and fewer sexual encounters. In a national sample of 20–49 year olds, obese and overweight women reported fewer partners in the past year than normal weight women [21]. Moreover, a study of 416 adolescents showed that obese girls were less likely to date than their average-weight peers [22], and another study showed obese women were less likely to have a sex partner in

the past 6 months than normal weight women [23]. In a study of men who have sex with men, normal weight and overweight men were 3.6 times more likely than obese MSM to have had unprotected sex [24]. Within a sexual risk framework, this evidence suggests that obese individuals may have less sex and fewer partners compared to normal weight individuals, which may in turn relate to reduced sexual risk.

These two possible relationships between BMI and sexual risk have emerged in the literature, leading to mixed findings and ambiguity. For example, a recent study using a national database found that BMI did not relate to sexual frequency or number of sexual partners but did relate to ever having sex [25]. Furthermore, there is even less evidence examining the relationship of BMI and STIs. One group, Nagelkerke and colleagues [21], assessed the direct effect of BMI on STI prevalence and found no difference between BMI groups on herpes serostatus. This study was limited as it looked at prevalence of a national sample with low rates of STIs.

No studies to our knowledge have evaluated psychosocial risks, sexual frequency, and STIs at the same time, particularly among young, socio-economically disadvantaged women during a time of heightened risk for obesity and sexual risk (e.g., early parenting). Furthermore, no studies have looked at other sexual risk outcomes (e.g., risky partners, casual partners) and potential psychosexual risk mechanisms (e.g., self-efficacy, communication). The aims of this study were to: (1) compare 6-month postpartum BMI groups (normal weight, overweight and obese) on psychosocial and psychosexual risk assessed 6 months postpartum; (2) compare 6-month postpartum BMI groups on STI incidence and sexual risk behavior 12 months postpartum; and (3) assess differential mechanisms of STI incidence and sexual risk across BMI groups. We focused on the postpartum period as changes in weight and sexual behavior during pregnancy and the immediate postpartum period could potentially confound the results. Sexual behavior has been shown to be stable by 6-months postpartum and STI rates have been demonstrated to be highest at 12-months postpartum [26].

Methods

Participants and Procedures

Data for this study come from a subanalysis of a large randomized control trial of 1047 pregnant young women (ages 14–25) aimed at promoting general and reproductive health through group prenatal care [27, 28]. The group-based intervention targeted prenatal health care behaviors including sexual and reproductive health. All participants consented to be randomized into the trial and were not separately enrolled to participate in this study. All inclusion and exclusion criteria pertain to the larger randomized controlled trial.

Participants were recruited from obstetrics clinics in two hospitals in New Haven, CT and Atlanta, GA. African-American and Latina women with limited financial resources are over-represented in the sample, reflecting the population of these clinics. Of the 1538 eligible young women, 1047 enrolled in the trial (68% participation rate). Those who agreed to participate were more likely to be African-American, older, and at a later gestational age at initial screening than those who refused to participate (all $P < .05$). Participants were interviewed 4 times. Baseline interviews occurred in the second trimester (Mean = 18 weeks gestation, SD = 3.3). Follow-up interviews were completed in the third trimester (Mean = 35 weeks gestation, SD = 3.1) and 6 and 12 months postpartum. These analyses use the 6- and 12-month postpartum data.

Of the 1047 participants, 787 (75.2%) completed the 6-month postpartum assessment, 840 (80.2%) completed the 12-month postpartum assessment, and 737 completed both the 6- and

12-month postpartum assessment. There were only 33 participants that were classified as underweight. Therefore, they were not included in the analyses. The final sample size used for this study was 704. There were no significant differences between participants included in these analyses and those excluded ($n = 343$) on any demographic or key study variables.

Between September 2001 and December 2004, young women attending prenatal care were referred by a health care provider or approached directly by research staff. Inclusion criteria were: (a) pregnant at less than 24 weeks gestation; (b) age at last birthday less than or equal to 25; (c) no severe medical problem requiring individualized assessment and tracking as a “high-risk pregnancy” (e.g., diabetes, hypertension, HIV); (d) able to speak English or Spanish; and (e) willingness to be randomized. Potential participants were screened and, if eligible, research staff explained the study in detail, and obtained informed consent. Participants were paid \$20 for each interview. Procedures were approved by Human Investigation Committees at both sites (Yale #11972 and Emory #197-2001).

Structured interviews via audio computer assisted self interviewing (audio-CASI) were conducted upon study entry. Audio-CASI allows respondents to listen over headphones to spoken questions that have been digitally recorded and stored on a computer, as well as displayed on the computer’s screen. This technology helps participants who have lower reading skills complete psychological and behavioral measures with greater ease [29].

Measures

BMI groups were assessed using self-reported weight and height during the 6-month postpartum assessment. We used BMI groups instead of treating BMI as a continuous measure for several reasons. First, the use of BMI groups is consistent with clinical practice, targeted behavioral interventions, and to guide health care and behavioral recommendations [30–33]. Second, use of these BMI groups are consistent with recent Institute of Medicine and CDC guidelines [31, 33]. The CDC classification was used to categorize participants as normal weight (BMI = 18.6–24.9), overweight (25–29.9) and obese (30 and above) [33]. Because clinically measured BMI was not available for all participants, we assessed the accuracy of the self-reported weights by comparing the self-reported weight of a subsample of women with medical records from their postpartum visits. A strong positive correlation was observed between the self-reported and measured weight (Pearson $r = 0.96$), confirming the validity of the self-reported weights included in the subsequent analyses.

STI acquisition was assessed by using two measures: biological testing and self-report at the follow-up interview. *Biological LCR Testing.* At each follow-up interview, urine samples were collected and tested for Chlamydia and gonorrhea using Strand Displacement Amplification (SDA) testing (BD Diagnostic Systems, Sparks, MD). *Self-Report.* Participants were also asked at each interview if they were diagnosed with an STI (Chlamydia, gonorrhea) since their previous interview. For each reported STI, participants were asked the date of their most recent diagnosis. Participants were classified as having an incident STI if (1) they tested positive for Chlamydia or gonorrhea at the 12-month postpartum interview with SDA testing or (2) they reported being diagnosed with an STI after the 6-month postpartum interview. This technique captured STIs that may have been tested and treated between interviews.

Sexual Risk Behavior. We used a sexual risk instrument we have validated on pregnant adolescents and young adult [34, 35]. *Percentage of condom use* was assessed by averaging the percentage of times they used condoms in the past 6 months across all partners. Individuals were coded as having *multiple partners* (multiple partners vs. single partner) if they reported two or more partners in the last six months. Individuals were categorized as having a *risky partner* if they reported having sex in the last six months with a partner who

had any of the following characteristics: injection drug user, HIV positive, history of an STI, and had sex with another person in the past six months. Individuals were categorized as having a *casual partner* if they reported having a partner that they rated as “not at all committed” or “a little committed” vs. “somewhat committed” or “very committed” in the past 6 months. *Number of intercourse occasions* was assessed by asking participants how many times they had sex in the past 30 days. *Number of unprotected intercourse occasions* was assessed by subtracting the number of times they used condoms in the past 30 days from the number of intercourse occasions.

Sexual History Variables

Participants were categorized as having a *history of an STI*, if they reported ever having any of the following STIs: Chlamydia, trichomonas, genital herpes, genital warts or HPV, gonorrhea, or syphilis. In addition, participants were asked the total number of sexual partners they ever had, the age at first sexual intercourse, whether they had ever demanded a partner use a condom, and parity (i.e., number of times gave birth).

Psychosocial Variables

Stress was assessed using the 10-item Perceived Stress Scale (PSS) [36]. Participants were asked how often they felt certain ways in the past month. Sample items include “Unable to cope with all of the things you had to do” and “Nervous and stressed.” All responses were on a 5-point Likert type scale (0–4), ranging from “never” to “very often” with higher scores indicating more perceived stress. Results showed good internal consistency ($\alpha = .81$). *Self-Esteem* was assessed using the 10-item Rosenberg Self-Esteem scale [37]. Sample items included “In general, I am satisfied with myself” and “I am able to do things as well as most people.” All responses were on a 4-point Likert-type scale (1–4), ranging from “strongly disagree” to “strongly agree.” Higher scores indicated more positive self-esteem and results showed good internal consistency ($\alpha = .85$). *Depression* was assessed by the 15 cognitive-affective items of the Center for Epidemiological Studies-Depression (CES-D) [38]. Respondents rated the frequency with which they have experienced various depression symptoms (e.g., sadness, crying, hopelessness) over the last 7 days. The scale ranged from 0 to 45 with higher scores indicating more depressive symptoms. Results showed good internal consistency ($\alpha = .85$). *Social support* was assessed using the 7-item subscale of the Social Relationship Scale [39] which assessed perceived availability of emotional and material support. Sample items included “Would people in your personal life be available to talk to you if you were upset, nervous or depressed” and “Are there people in your life who would help take care of you if you had to stay in bed for several weeks?” All responses were on a 5-point Likert-type scale (1–5), ranging from “never” to “very often.” Higher scores indicated more perceived social support. Cronbach alpha for the measure was .89. *Social conflict* was assessed using the 7-item social conflict subscale of the Social Relationship Scale and assessed the perceived degree of conflict in an individual’s social network [39]. Sample items included “Have the people in your personal life really gotten on your nerves” and “Have you felt irritated or resentful toward people in your personal life?” All responses were on a 5-point Likert-type scale (1–5), ranging from “definitely not” to “definitely yes.” Higher scores indicated more perceived social conflict. Cronbach alpha for the measure was .84.

Psychosexual Variables

Peer condom use norms was assessed using a 5-item scale [40]. Sample items included “Most women I know use condoms when they have sex with men.” All responses were on a 4-point Likert scale (1–4) ranging from “strongly disagree” to “strongly agree.” Higher scores indicate more positive peer norms toward condom use. Results showed adequate internal consistency ($\alpha = .79$). *Condom use self-efficacy* was assessed using 6 items

including “How sure are you that you could use a condom correctly or explain to your partner how to use a condom correctly?” All responses were on a 4-point Likert scale (1–4) ranging from “not at all sure” to “very sure.” Higher scores indicate more condom use self-efficacy. Results showed adequate internal consistency ($\alpha = .78$) [41]. *Safe sex communication* was assessed by 4 items. Participants responded whether they had asked or demanded to use a condom in the past 6 months [42], and the number of times in the previous month condoms and HIV concerns were discussed with their partner [40]. Responses were coded as talking about condoms or HIV concerns 0 versus 1 or more times. Items were summed (range 0–4) with higher scores indicating safer sex communication and showed adequate internal consistency ($\alpha = .74$). *Perceived HIV/STI risk* was assessed using 2 items that participants rated their perceived susceptibility to getting an STI and HIV in the next year, from 0 = “no chance” to 3 = “good chance” [43]. Results showed good internal consistency ($\alpha = .83$).

Demographic Variables. Participants’ age was recorded. For analyses, race was categorized as African-American, Latina, White/Other. *Employment status* assessed whether participants were not employed versus employed full or part-time. Participants were asked whether they were “currently in a relationship”, whether they were in a “relationship with the father of the baby”, and whether they were “living with the father of the baby”. *Weight change* was assessed for two durations: from pre-pregnancy to 12-months postpartum (by subtracting self-reported weight 12-months postpartum from self-reported weight immediately prior to becoming pregnant); and from 6-months post-partum to 12 months postpartum (by subtracting self-reported weight 12-months postpartum from self-reported weight 6-months postpartum). Substance use was assessed by asking participants if they “smoked”, “drank”, or used “marijuana” in the past 30 days. All demographic variables were assessed 6 months postpartum.

Data Analysis

First, we compared BMI groups on demographic and sexual history variables using ANOVA analyses (for continuous variables) and chi-square analyses (for categorical variables). Any differences found between the BMI groups were controlled for in subsequent analyses. Furthermore, we controlled for experimental group and race regardless of initial differences for conceptual and methodological reasons. Experimental group was added as a covariate in all subsequent analyses in order to control for any possible effects of the intervention.

To meet the first aim of comparing 6-month postpartum BMI groups on psychosocial factors and psychosexual risk assessed 6 months postpartum, we conducted ANCOVA analyses controlling for age, parity, race, and experimental group. To meet the second aim of comparing BMI groups on STI incidence and sexual risk behavior 12 months postpartum, we conducted ANCOVA analyses (for continuous variables) and logistic regression analyses (for dichotomous variables) controlling for age, parity, race, experimental group, history of an STI, age at first intercourse, and number of lifetime partners for the sexual risk outcomes and STI incidence at 12-months postpartum. If BMI related to outcomes, we assessed for possible mediation of the psychosocial and psychosexual risk factors using steps outlined in Baron and Kenny [44]. Finally, to meet the third aim to assess differential predictors of STI incidence and sexual risk between BMI groups, we assessed for significant interactions using logistic regression. Backward selection was used to assess which of the demographic, sexual history, psychosocial, and psychosexual variables at 6-months postpartum predicted sexual risk and STI outcomes at 12 months postpartum. In addition for STI incidence at 12 months postpartum, sexual risk variables at 6 months postpartum were also used as predictors. An approach outlined by Hosmer & Lemeshow was used where interaction effects were added one-by-one to the model [45]. Significant interactions ($P < .05$) were

included in the final model. All continuous variables were centered prior to creation of the interaction term.

Results

Of the 704 participants used in these analyses, 77% were African-American, 15% were Latina, 6% were White, 2% were Native American, and 1% was Asian. The average age was 21.4 years ($SD = 2.6$). Thirty-six percent of participants were still in high school. Of those who were no longer in school, 40% never completed high school, 43% had a high school diploma or GED, and 17% had more than a high school education. For 63% of participants, this was their first child.

Exploration of the BMI groups showed that 29% of participants were normal weight, 31% were overweight, and 40% were obese. Table 1 shows the differences between the 6-month postpartum BMI groups on demographic and sexual history variables. Obese participants were significantly older than normal weight and overweight participants. Normal weight participants were more likely to have just had their first child than overweight and obese participants. No other differences were found.

Comparing BMI Groups on 6-Month Postpartum Psychosocial and Psychosexual Variables

Next, we assessed differences between the BMI groups on psychosocial and psychosexual variables assessed at 6 months postpartum controlling for age, parity, race, and experimental group. Results (see Table 2) showed significant differences between the groups on stress, self-esteem, depression, social support, and social conflict (all $P < .05$). Tukey HSD post-test analyses showed that obese participants had more stress, depression and conflict, and less self-esteem and social support than normal weight and overweight women (all $P < .05$). In addition, overweight women had less stress than normal weight women ($P < .05$). For the psychosexual variables there were significant differences between BMI groups for sexual communication and peer norms. Obese women had significantly lower peer norms for condom use than overweight and normal weight women (all $P < .05$). However, obese and overweight women had significantly better sexual communication than normal weight women.

Comparing BMI Groups on 12-Month Postpartum STI Incidence and Sexual Risk Behavior

Next, we looked at differences between BMI groups on continuous sexual risk behavior at 12 months postpartum using ANCOVA (see Table 2). There were no differences in condom use, number of sex occasions, and number of unprotected sex occasions. Next, we looked at the association of BMI groups on multiple partners or sex with casual partners at 12 months postpartum using logistic regression (see Table 3). There was no association between BMI groups and having a casual partner 12 months postpartum. However, there was a significant effect for risky partner ($\chi^2 = 7.07$, $P < .05$). Results of the logistic regression showed that the odds of having a risky partner were 1.7 times ($P < .05$) more likely for overweight participants compared to normal weight participants. There were no differences between obese and normal weight participants on sex with a risky partner.

Next, we compared BMI groups on STI incidence and sexual risk behaviors at 12 months postpartum. There was a significant difference in STI incidence between BMI groups ($\chi^2 = 21.55$, $P < .001$). Results of the logistic regression showed that the odds of having an incident STI were 1.8 times ($P < .05$) more likely for overweight women compared to normal weight women and 0.6 times ($P < .05$) as likely for obese women compared to normal weight women. Therefore, there was a non-linear effect with obese women having

the lowest STI incidence and overweight women having the highest STI incidence (see Table 3).

Next, we assessed possible mediators of the effect of BMI on the two sexual risk outcomes that we found that differed between BMI groups (e.g., STI, risky partner). In order to show mediation, BMI needs to relate to the potential mediator [44]. Therefore, as shown in Table 2, stress, self-esteem, depression, social support, social conflict, peer norms for condom use, and safer sex communication were all potential mediators. We used backward selection to enter the psychosocial and psychosexual predictors listed in Table 2, and sexual behaviors at 6 months postpartum (e.g., number of unprotected sex acts, sex with casual partners).

For STI incidence at 12 months postpartum, using backward selection, the final model showed younger age (OR = 0.90, 95% CI = .78–.95), history of an STI (OR = 1.92, 95% CI = 1.24–2.96), not living with the father of the baby (OR = 0.44, 95% CI = 0.28–0.79), and having a casual partner at 6-months postpartum (OR = 1.82, 95% CI = 1.17–2.84) related to STI incidence at 12 months postpartum. None of the potential mediators were included in the final model. Furthermore, BMI groups remained significant in the final model (OR = 1.8 for overweight versus normal weight; OR = 0.6 for obese versus normal weight, both $P < .05$). This showed that psychosocial and sexual variables did not mediate the relationship between BMI and STIs.

For having a risky partner, women with a history of an STI (OR = 2.17, 95% CI = 1.43–3.26), and those not in a relationship with the father of the baby (OR = 0.50, 95% CI = 0.32–0.70) were more likely to have a risky partner at 12 months postpartum. None of the potential mediators were included in the final model and BMI groups remained significant in the final model (OR = 1.6 for overweight versus normal weight, $P < .05$), showing that psychosocial and sexual variables did not mediate the relationship between BMI and risky partner.

Assess Differential Mechanisms of STI Incidence and Sexual Risk Across BMI Groups

Next, we assessed interactions between predictors and BMI groups for STI incidence. Table 4 summarizes the results of the interaction effects by showing which variables related to outcomes across all three BMI groups and which variables uniquely predicted outcomes for each BMI group. Two significant interactions were found: self-esteem by BMI ($\chi^2 = 8.35$, $P < .05$) and peer norms by BMI ($\chi^2 = 7.57$, $P < .05$). Stratified analyses were conducted to assess the nature of the interactions. Results showed that self-esteem related to more STI incidence for normal weight individuals (OR = 1.13, 95% CI = 1.02–1.25), and did not relate for overweight (OR = 1.02, 95% CI = 0.92–1.16) and obese individuals (OR = 0.95, 95% CI = 0.91–1.12). For peer norms, lower peer norms toward condom use significantly related to STI incidence for obese women (OR = 0.86, 95% CI = 0.80–0.93) but did not relate for normal weight (OR = 0.95, 95% CI = 0.83–1.17) or overweight women (OR = 1.14, 95% CI = 0.92–1.26).

Next, we assessed any interactions between predictors and BMI groups for having a risky partner. Interaction effects were found for stress, self-esteem, social conflict and alcohol use (all $P < .05$). Stratified analyses showed that stress related to having a risky partner at 12 months postpartum for obese women (OR = 1.10, 95% CI = 1.03–1.17), but did not relate for overweight women (OR = 0.99, 95% CI = 0.92–1.05) or normal weight women (OR = 0.95, 95% CI = 0.88–1.03). Self-esteem related to more likelihood of having a risky partner for normal weight women (OR = 1.09, 95% CI = 1.01–1.20) but did not relate for overweight (OR = 0.97, 95% CI = 0.90–1.04) or obese women (OR = 0.95, 95% CI = 0.88–1.01). Social conflict related to having a risky partner for obese women (OR = 1.09, 95% CI = 1.04–1.14) and overweight women (OR = 1.09, 95% CI = 1.13–1.04), but did not relate

for normal weight women (OR = 1.00, 95% CI = 0.94–1.05). Finally, use of alcohol 6 months postpartum significantly related to having a risky partner 12 months postpartum for overweight women (OR = 3.07, 95% CI = 1.48–6.36), but did not relate for obese women (OR = 0.95, 95% CI = 0.47–1.92) or normal weight women (OR = 1.39, 95% CI = 0.64–3.02).

Additionally, since having a casual sex partner was the only sexual risk variable that related to STI incidence at 12 months postpartum, we explored possible differential mechanisms by BMI group. Results showed that those who were not in a relationship with the father of the baby (OR = .60, 95% CI = 0.37–0.95), and who drank alcohol in the past 6 months (OR = 1.67, 95% CI = 1.11–2.49) were more likely to have a casual partner at the 12-month postpartum period. Significant interactions with BMI group were found for stress, social conflict, and perceived STI/HIV risk (all $P < .05$). Stratified analyses showed that increased stress at 6 months postpartum related to having a casual partner at 12 months postpartum for obese women (OR = 1.09, 95% CI = 1.04–1.15) but did not relate for overweight women (OR = 1.04, 95% CI = 0.99–1.09) or normal weight women (OR = 1.01, 95% CI = 0.96–1.06). Social conflict related to more likelihood of having a casual partner for obese (OR = 1.09, 95% CI = 1.04–1.14) and overweight women (OR = 1.08, 95% CI = 1.02–1.13), but did not relate for normal weight women (OR = 0.99, 95% CI = 0.94–1.04). Finally, perceived risk related to more risk for casual partners for obese women (OR = 1.62, 95% CI = 1.22–2.15), but did not relate for overweight women (OR = 0.90, 95% CI 0.65–1.24) or normal weight women (OR = 1.23, 95% CI = 0.87–1.74).

Finally, it should be noted that weight change from pre-pregnancy to 6-months and from 6- to 12-months post-partum did not significantly relate to any of the 12-month sexual risk outcomes controlling for BMI (i.e., weight change did not end up in any of the sexual risk outcome models). In addition, there was no significant weight change by BMI interactions.

Discussion

Results from this study showed that BMI significantly related to STI incidence and sexual risk. Overweight women were at increased risk for STI incidence compared to normal weight women and obese women. However, being obese was protective for STIs, with obese women significantly less likely to have an incident STI compared to normal weight and overweight women. Therefore, there was a complicated relationship between BMI and STI risk that may explain some of the contradictory findings in previous research [20, 46].

Neither of the two explanations of the relationship between BMI and sexual risk was fully supported. Although obese individuals had worse psychosocial functioning (e.g., lower self-esteem, more depression), they had less STIs and risky partners. Furthermore, psychosocial variables did not mediate the relationship between BMI and STIs. In addition, differences in STI incidence occurred despite a lack of difference in frequency of sex, number of unprotected sex acts, and number of partners. Normal weight, overweight, and obese women had similar amounts of protected and unprotected sex, and number of partners, but still differed on STI incidence. This suggests that it may not be the type of behavior influencing STI differences between these groups, but rather the type of partner. This is supported by the differences found between groups on sex with a risky partner. Overweight women were more likely to have sex with a risky partner compared to obese and normal weight women. Given the potential role the type of partner may have on differences in STI incidence between weight groups, couple studies may provide insight into the partner's role in sexual risk by BMI group. Couple studies would allow us to assess partner characteristics (e.g., concurrent sex, satisfaction with their partner's body type, BMI) that relate to STI incidence and sexual risk.

Exploration of the differential mechanisms between weight groups provides some insight into what may be causing risk among the groups. For overweight women, alcohol use and high levels of social conflict related to having a risky partner at 12-months postpartum suggesting that overweight women may deal with conflict through risk-taking behavior such as sex and drinking. Interventions for this group should focus on using active coping strategies to deal with conflict.

Obese women had the lowest levels of STI despite having significantly worse psychosocial functioning. Obese women had more stress, depression, social conflict and less social support and self-esteem than normal weight and overweight women, supporting previous research [4, 5]. However, these negative psychosocial effects did not translate to increased sexual risk. This is contrary to previous findings showing that stress, depression, and self-esteem are linked to sexual risk [9–12]. However, it should be noted that the interactions suggest that psychosocial factors play a role in predicting sexual risk behavior for obese women, but do not play the same role for normal weight and overweight women. Stress and social conflict related to having sex with risky and casual partners for obese women but did not relate for normal weight women. These findings suggest that obese women with elevated levels of psychological distress may have increased sexual risk behavior. It should be noted that for obese women, these affective predictors were as important as traditional social-cognitive predictors (e.g., peer norms, perceived risk) that are central to most HIV-prevention theories (e.g., Information Motivation Behavior, Theory of Planned Behavior). This evidence suggests that prevention programs should incorporate techniques that help regulate affect in addition to approaches that change cognitions (e.g., such as attitudes, knowledge, and intentions).

The different levels and mechanisms of sexual risk identified between BMI groups in this study suggest that it might be useful to discuss BMI and body weight issues when dealing with issues of sexuality and sexual risk in HIV interventions. No HIV interventions, to our knowledge, have incorporated issues of body weight. This is surprising given the importance of BMI on how individuals view themselves, their body, and their sexuality [20, 47].

Furthermore, our results showed that young mothers were at high risk for overweight and obesity, and sexual risk. Seventy-one percent of young mothers in our sample were overweight or obese. Furthermore, these women engaged in high levels of sexual risk and had high rates of STIs 12 months postpartum. These results suggest that prevention programs that target a broad range of risk behaviors and health outcomes are needed for young mothers. Several programs have been developed to deal with mental, physical, and reproductive health issues of young pregnant and parenting women [27, 48–50]. For example, one program that integrates sexual, reproductive, mental, and prenatal health into prenatal care showed improved mental health, reduced sexual risk, improved birth outcomes, and increased breastfeeding [27, 28]. Another hospital based program for young mothers focuses on medical, psychosocial, educational, and family planning support and achieved improved outcomes across a variety of domains including contraceptive behavior, health care utilization, maternal and infant morbidity, and educational attainment [50]. Our results support the need for comprehensive programs like these, and suggest incorporating sexual risk and weight loss components to these types of programs.

This study had several limitations. We used a high-risk urban clinic-based sample of young mothers. Given the high STD rate 12 months postpartum, this sample may be behaviorally different than a random sample of young mothers. However, these are the women who are most at risk for STIs and represent a group who may benefit from prevention programs. Another limitation is that given our assessment of BMI at a fixed time point (6 months postpartum) and outcomes at a subsequent time point (12 months postpartum), BMI category

may have shifted from 6 to 12 months which could have affected results. This possibility is slight given that weight change from 6 to 12 months postpartum was assessed as a possible covariate and did not relate to outcomes. Another limitation is that since we relied on self-report assessment of participants, reporting biases could occur. This may have led to differential misreporting which may have influenced some of the results. However, our data support the validity of the self-reported weight with a nearly perfect correlation ($r = .96$) between self-reported and medical record data. Another limitation is that these data were taken from the responses of women participating in a large randomized control trial. Therefore, there may be selection bias of women willing to engage in an RCT. Another limitation is that we did not assess all possible variables that may have explained the relationship between BMI and sexual risk. The most notable omission is body image which has been shown to relate to both BMI and sexual risk [46]. Therefore, it is possible that being overweight and being at risk for STIs is due to some unmeasured third variable. While this study found significant associations, the odds ratios demonstrated small effect sizes. Therefore, further research is needed to substantiate these results. It also should be noted that we used the term mediation to test possible mechanisms between BMI and sexual risk. Our mediation analyses were consistent with the various conceptual models presented in the literature. However, mediation implies a variable is on the causal pathway, and given the design of this study, causality cannot be determined. Finally, since this population was fairly racially skewed (i.e., 77% African-American), cultural differences regarding weight and perceptions of “overweight” may have influenced the results and may not generalize to broader populations. Other studies have found that African-Americans are more accepting of larger body sizes for themselves and their partners [51, 52]. More research is needed that compares these results across race. Although we found no significant race by BMI interactions for sexual risk or STIs, the small numbers in the white and Latina groups limit our power to detect effects.

Despite these limitations, this study was one of the first to explore the association of BMI on STI and a broad range of sexual risk behaviors among a sample of high risk young women. Our results support the importance of the association between BMI and sexual risk, and suggest the need for sexual risk prevention and weight loss programs among young mothers.

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Fig. 1.
Model of two different possible associations between BMI and sexual risk

Table 1

Differences on demographic and sexual history variables by BMI group

	BMI group				Test statistic			
	Normal weight (18.6–24.9) N = 206		Overweight (25.0–29.9) N = 219		Obese (30.0+) N = 279			
	Mean	SD	Mean	SD	Mean	SD	F	
Demographics								
Age	21.1	2.6	21.2	2.7	21.7	2.6	3.86*	
Relationship duration	23.1	24.4	28.7	27.6	27.0	30.0	2.29	
	N	%	N	%	N	%	χ^2	
Race								
African-American	155	75.4%	172	78.4%	214	76.7%	2.56	
Latina	30	14.7%	32	14.5%	35	12.6%		
White/other	21	10.0%	15	7.0%	30	10.7%		
Employment Status								
Full-time	34	16.6%	37	16.7%	45	16.3%	4.31	
Part-time	44	21.3%	46	21.2%	42	15.2%		
Unemployed	128	62.1%	136	62.1%	192	68.5%		
Parity								
1	147	71.6%	131	59.9%	169	60.4%	8.33*	
2 or more	59	28.4%	88	40.1%	110	39.6%		
In a relationship	151	73.5%	175	79.7%	204	73.0%	3.58	
Alcohol and substance use								
Smoke past 6 months	54	26.1%	55	25.1%	73	26.3%	0.10	
Drink past 6 months	61	29.4%	66	30.0%	66	23.7%	3.02	
Marijuana past 6 months	21	10.0%	22	10.0%	19	6.7%	2.73	
	Mean	SD	Mean	SD	Mean	SD	F	
Sexual history								
# Lifetime sex partners	5.8	5.0	6.4	5.7	6.6	5.8	1.44	

	BMI group				Test statistic			
	Normal weight (18.6–24.9)		Overweight (25.0–29.9)		Obese (30.0+)		F	
	N = 206		N = 219		N = 279			
	Mean	SD	Mean	SD	Mean	SD		
Age at first intercourse	15.4	2.0	15.1	1.7	15.0	2.0	2.47	
	N	%	N	%	N	%	χ^2	
History of an STI	93	45.0%	110	50.2%	152	54.4%	2.60	
Ever demanded condom use	142	69.0%	166	76.0%	218	78.0%	4.82	

* $P < .05$

Table 2

Differences on psychosocial and sexual psychosocial by BMI group

	BMI group at 6-months postpartum				Test statistic		
	Normal weight (18.6–24.9)		Overweight (25–29.9)		Obese (30+)		
	N = 206		N = 219		N = 279		
	Mean	SD	Mean	SD	Mean	SD	F
Psychosocial variables 6-months postpartum ^a							
Stress	16.1	6.6	15.1	7.0	17.1	7.0	5.12**
Esteem	34.3	4.8	34.8	4.9	33.5	5.2	4.06**
Depression	9.0	7.1	9.2	7.9	11.0	7.9	4.64**
Social support	29.7	5.7	30.3	5.4	28.8	6.7	3.97**
Social conflict	18.9	6.6	18.3	7.2	20.0	7.3	3.81*
Sexual psychosocial variables 6-months postpartum ^a							
Peer norms for condom use	12.65	3.0	12.49	3.2	11.87	3.4	3.89*
Condom use self-efficacy	22.41	2.6	22.53	2.7	22.26	3.0	0.55
Safer sex communication	2.29	1.5	2.59	1.4	2.63	1.4	3.79*
HIV/STI perceived risk	2.49	.94	2.54	1.1	2.47	.91	0.36
Sexual risk variables 12-months postpartum ^b							
Condom use past 6-months	45.3	40.3	45.1	39.9	47.9	40.4	0.29
Number of sex occasions past 30 days	8.2	8.6	7.9	8.0	8.1	8.2	0.07
Number of unprotected sex occasions past 30 days	5.6	7.7	5.5	6.9	5.3	7.4	0.10

Notes: All analyses were conducted using ANCOVA

^aControlling for age, parity, race, experimental group^bControlling for age, parity, race, experimental group, STI history, age at first intercourse, and number of lifetime sexual partners** $P < .01$ * $P < .05$

Table 3

Relationship BMI group on sexual risk behavior at 12-months postpartum

BMI group	STI incidence		Multiple partners past 6 months		Casual partner past 6 months		Risky partner past 6 months	
	% Yes	OR(95% CI)	% Yes	OR (95% CI)	% Yes	OR (95% CI)	% Yes	OR (95% CI)
Normal	18.5%	Referent	15.9%	Referent	23.2%	Referent	19.5%	Referent
Overweight	29.0%	1.83* (1.1–2.9)	17.1%	1.33 (0.8–1.9)	22.9%	0.98 (0.6–1.5)	25.6%	1.67* (1.1–2.1)
Obese	10.9%	0.61* (0.3–0.9)	18.3%	1.31 (0.9–1.7)	20.0%	0.92 (0.5–1.6)	19.3%	0.98 (0.6–1.5)

Notes: Controlling for age, parity, race, experimental group, STI history, age at first intercourse, and number of lifetime sexual partners; Analyzed with Logistic Regression

*** $P < .01$

* $P < .05$

Table 4

Summary of common and unique predictors of STI, risky partner, and casual partners among BMI groups

Outcome 12-months postpartum	Predictors of sexual risk outcomes			
	Common across all groups	Normal weight women	Overweight women	Obese women
STI	Younger age	Higher self esteem		Lower peer norms for condom use
	History of an STI			
	Not living with father of the baby			
	Having a casual sex partner			
Risky partner	History of an STI	Higher self esteem	More social conflict	More social conflict
	Not living with father of the baby			
Casual partner			More alcohol use	More stress
	Not in a relationship with the father of the baby		More social conflict	More social conflict
				More stress
	More alcohol use			More perceived STI/HIV risk