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Stress and Depression are Associated with Sexual Function and Satisfaction in Young Men who have Sex with Men

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Abstract

Prior research suggests that better mental health and higher relationship quality are associated with better sexual function and satisfaction. Such insights can inform intervention development for mental, relationship, and sexual health concerns. This study examines the interactions among these variables in a racially and ethnically diverse group of young men who have sex with men (YMSM) in serious relationships (N=348). Data were drawn from wave 5 of a longitudinal cohort study. We examined cross-sectional associations between depression and stress (predictors) and sexual function, sexual satisfaction, and anal discomfort (outcomes) and to what extent these associations were moderated by relationship quality. Higher endorsement of depression and stress was associated with worse sexual functioning, lower sexual satisfaction, and more anal discomfort. We also found that fewer negative interactions, stronger commitment, and higher relationship satisfaction were associated with better sexual functioning and higher sexual satisfaction. Higher relationship satisfaction and commitment were found to attenuate the association between stress and sexual satisfaction. Contrary to expectations, higher relationship satisfaction also showed a trend toward exacerbating the association between depression and sexual functioning. These results suggest that for YMSM, high relationship satisfaction and commitment may protect sexual satisfaction from being negatively impacted by high stress. However, YMSM in highly satisfying relationships may experience poor sexual functioning associated with depression as particularly distressing. This study addressed a major gap in the literature by focusing on mental, relationship, and sexual health in a diverse sample. Future research should examine a wider range of sexual functioning outcomes and include minority stress in study design.

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Keywords

sexual and gender minorities; sexual functioning; relationship functioning; depression; mental health

Introduction

Prior research has generally found that stress and depression are associated with worse sexual functioning and satisfaction (Bancroft et al., 2003; Forbes et al., 2016; Hirshfield et al., 2010; McMillan et al., 2017; Smith et al., 2010; Tutino et al., 2018; Ventus et al., 2017), although there are important individual differences in the association (Janssen et al., 2013). Furthermore, serious, committed relationships characterized by high satisfaction and low conflict can help protect against a negative influence of mental health on sexual concerns (Li et al., 2019; Smith et al., 2010). However, almost all of the research on sexual functioning, especially in the context of serious relationships, has been limited to heterosexual and cisgender samples with limited racial, ethnic, and age diversity (e.g. Boddi et al., 2015; Burri et al., 2012; Tutino et al., 2018). Research that does include men who have sex with men (MSM) is still generally limited to White men from middle and older age groups (e.g., Bancroft et al., 2003; Hart et al., 2015). Research continues to demonstrate that people belonging to marginalized groups, such as racialized sexual minorities, are at increased risk for mental health disorders (Lee et al., 2017; Mills et al., 2004), problematic relationships (Chen et al., 2020; Whitton et al., 2019), and sexual health concerns (Barbonetti et al., 2019). These individuals also have more negative experiences in health care and poorer outcomes of treatment (Langston et al., 2019; Morris et al., 2022). To adequately serve these individuals, it is vital we have research to improve the understanding of the interplay of factors contributing to distress among more diverse groups (Madireddy & Madireddy, 2022). The current study fills an important gap in the literature by examining the interactions between sexual functioning and satisfaction, mental health, and relationship functioning among a racially and ethnically diverse group of young men who have sex with men (YMSM) in serious relationships. Insights on the interactions between mental health, relationship functioning, and sexual health provide important guidance to clinicians on likely comorbidities as well as different possible paths for change.

Sexual Functioning in YMSM

The dual control model (Bancroft et al., 2009) describes sexual response as the result of the interaction between sexual excitation and sexual inhibition systems. Sexual excitation is activated by sexually relevant stimuli (e.g., visual, auditory, or tactile stimuli); sexual inhibition is activated by internal or external cues that suggest sexual activity would not be currently safe or desirable (e.g., danger of negative interpersonal consequences, stress or low mood, fear of sexually transmitted infections). According to the dual control model, there is individual variability in propensity for sexual excitation/inhibition, and those with low propensity for sexual excitation and high propensity for sexual inhibition are more prone to sexual dysfunction. Furthermore, once one experiences impaired sexual response, worry or performance anxiety in future sexual situations can further activate the sexual

inhibition system, exacerbating sexual difficulties. There is some support for this model in both heterosexual and gay men (Bancroft et al., 2003, 2005).

Research on the prevalence of problems with sexual function in MSM has primarily focused on erectile dysfunction (ED) and has mixed results. According to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), ED in the general population is thought to affect between 7%–18% of adult men (American Psychiatric Association, 2013). While estimates of ED among MSM range from equivalent to heterosexual men (Peixoto & Nobre, 2014) to as high as 45% (Hirshfield et al., 2010), a meta-analysis concluded that gay-identified men had significantly higher odds (OR = 1.5) of reporting ED compared to heterosexual men (Barbonetti et al., 2019). Minority stress due to stigma and victimization can both directly and indirectly (e.g., via anxiety) effect sexual functioning and may explain these higher rates of ED among MSM (Li et al., 2019). Furthermore, more frequent sex in the context of drug or alcohol use might also contribute to higher rates of ED among MSM (Barbonetti et al., 2019; Hirshfield et al., 2010).

Low sexual desire and difficulties with erection are often the most commonly reported symptoms of sexual dysfunction in MSM (Bancroft et al., 2003; McMillan et al., 2017; Peixoto & Nobre, 2014; Tutino et al., 2018); however, these symptoms appear to be stratified by age. YMSM tend to report more problems with sexual desire (as high as 65%) and pain with sex, while older MSM (> 30 years old) are more likely to report erection problems (Hirshfield et al., 2010; McMillan et al., 2017). However, these results are not entirely consistent across the literature: a study of YMSM (16–29 years old) found the most commonly reported sexual difficulty to be with erections (Li et al., 2019).

Most research on pain during sex has focused on the pain heterosexual women experience during penetrative sex, likely because the sexual pain disorders in the DSM exclusively consider pain related to penile-vaginal intercourse (American Psychiatric Association, 2013). However, pain with receptive anal sex is an important sexual dysfunction to consider for MSM (Rosser et al., 1998). Prevalence estimates for pain with anal sex range from 14%–24% (Hirshfield et al., 2010; Rosser et al., 1998). Some scholars have suggested that anal discomfort may be more prevalent among YMSM and may be associated with condom use (Hirshfield et al., 2010; McMillan et al., 2017). In the only longitudinal study of anal discomfort among MSM we could find, anal discomfort was associated with condomless receptive anal sex among YMSM. The authors suggested this association might be partly related to level of comfort in the role of the receptive partner and level of preparation needed for receptive anal sex (Li et al., 2020), both of which may be more likely to occur in the context of serious relationships.

Mental Health and Sexual Function/Satisfaction

Stress and depression are associated with worse sexual functioning and satisfaction in heterosexual men and MSM (Bancroft et al., 2005; Forbes et al., 2016; Hirshfield et al., 2010; Lee et al., 2017; McMillan et al., 2017; Peixoto & Nobre, 2014; Smith et al., 2010; Tutino et al., 2018; Ventus et al., 2017). MSM are at a higher risk of stress and depression compared to heterosexual men. MSM report distress and depression at rates over four times that of the general male population (Lee et al., 2017; Mills et al., 2004). Among MSM,

younger age groups are more likely to endorse depression and suicidality compared to their older or heterosexual counterparts (Hall, 2018; Hirshfield et al., 2010; Lee et al., 2017; Smith et al., 2010). Higher rates of mental health disorders among MSM are thought to be attributable to increased stress due to stigma, discrimination, and less availability of family-based social support (Hickson et al., 2016; Ivankovi et al., 2015; Lee et al., 2017; Li et al., 2020; Zamboni & Crawford, 2007). These high rates of mental health concerns and the impact of minority stress put MSM at risk for sexual dysfunction.

Mental health disorders have been linked to sexual function in multiple studies in the general population and among MSM. For example, a study of depression and sexual function in medical students reported that moderate to severe ED was associated with a six-fold increase in the odds of depressive symptoms, and mild ED associated with a three-fold increase (Smith et al., 2010). However, this study's sample was mostly White, high income, uniformly highly educated, and did not report on sexual orientation; as such, the generalizability of these results is unclear. MSM with symptoms of sexual dysfunction are significantly more likely to report a lifetime diagnosis of any mental illness (Hirshfield et al., 2010). Furthermore, there appear to be graduated effects such that more severe psychopathology (e.g., negative psychotic symptoms, poor medication adherence) is associated with more severe sexual dysfunction (McMillan et al., 2017). McMillan et al (2017) noted a high prevalence of sexual dysfunction among LGBTQ+ youth in their sample, which made up 40% of the cohort, but did not report the exact prevalence. Another study found that both mental health disorders and the treatments for said disorders (i.e., depression treated with anti-depressant medication) contributed to sexual dysfunction among MSM (Hart et al., 2015). Additional research has described an association between higher rates of victimization related to sexual orientation and increased risk of reporting sexual problems among MSM with depression (Ivankovi et al., 2015) and that perceived stigma was associated with lower sexual satisfaction (Li et al., 2019). It is possible that for minoritized groups, the association between mental health disorders and sexual dysfunction is even more pronounced. While the link between mental health concerns (whether due to minority stress or other factors) and sexual dysfunction is well established, the studies described above are correlational, and thus unable to draw conclusions about causal mechanisms.

Research examining the direction of causality between poor mental health and sexual dysfunction has found the relationship to be bi-directional (Forbes et al., 2016; Forbes & Schniering, 2013; Tutino et al., 2018; Ventus et al., 2017). For example, a structural equation modeling analysis of 985 men found that sexual distress predicted higher levels of anxiety and depression at a later time, *and* depression predicted sexual distress at a later time (Ventus et al., 2017). A latent variable analysis of 1,012 men and women found evidence that depression, anxiety and sexual problems are all aspects of a single, internalizing distress factor (Forbes et al., 2016). These findings were less consistent for men than for women, which the authors attributed to an independence between male engagement in sexual activity and the general internalizing factor (Forbes et al., 2016; Tutino et al., 2018). In other words, men may still seek sexual activity when depressed or unsatisfied in a relationship, but this does not preclude problems with sexual satisfaction or sex-related distress. As noted, there are also individual differences in this relationship (Janssen et al., 2013). Taken together, the

clinical picture of men presenting with sexual and mental health concerns is complex and multi-faceted.

In addition to the complexity of causality, researchers have also considered whether sexual dysfunction is always reflected by measures of sexual behavior. Prior research demonstrated a distinction between sexual problems and sexual behavior frequency in some men. While many MSM experience higher rates of sexual problems when in emotional distress, some men endorse heightened frequencies of sexual activity during negative mood states (Forbes et al., 2016; Forbes & Schniering, 2013; Tutino et al., 2018). In a study of the relationship between mood and sexuality among 662 gay-identified men, 16%–24% of the sample reported an increase in sexual activity when depressed or anxious (Bancroft et al., 2003). This is consistent with a study of young men's sexual health in which psychological risk factors appeared unrelated to sexual frequency (Tutino et al., 2018). However, motivating factors behind the men's increased sexual activity included seeking validation, caring less about risk, and desire for physical and social contact (Bancroft et al., 2003), *not* an increase in sexual desire. This pattern was particularly prevalent among young men (Bancroft et al., 2003; Forbes & Schniering, 2013), and re-emphasizes the unique ways that mental health and sexual dysfunction may present in YMSM.

Relationship Factors and Sexual Function/Satisfaction

Research suggests that satisfying, healthy relationships can help mitigate sexual dysfunction (Maxwell & McNulty, 2019). For example, among young men in serious relationships, high relationship satisfaction and quality were associated with high sexual satisfaction as well as better sexual functioning (Byers et al., 2021). Another study found a strong association between severe ED and familial and marital conflict among men (Boddi et al., 2015). However, these studies, like most of the literature, included predominantly heterosexual samples.

One study comparing gay-identified and heterosexual-identified men found that distressing sexual problems were associated with lower scores on the Dyadic Adjustment Scale, regardless of sexual orientation (Peixoto & Nobre, 2016). However, over 80% of the gay-identified sample and 47% of the heterosexual-identified sample described themselves as single, so it is unclear whether this is representative of those in serious relationships (Peixoto & Nobre, 2016). We identified two studies that examined aspects of sexual function and/or satisfaction in YMSM in serious relationships (Li et al., 2020; Newcomb et al., 2021). Participants in serious relationships were more likely to report more sexual interest and satisfaction than single participants (Li et al., 2020); furthermore, relationship satisfaction and commitment were associated with higher sexual satisfaction among those in committed relationships (Newcomb et al., 2021). Both studies also found that relationship structure impacted sexual satisfaction: agreements for non-monogamy (Li et al., 2020) and unspecified relationship agreements (Newcomb et al., 2021) were associated with low sexual satisfaction for participants in serious relationships; it is important to note that the direction of these associations are unknown as these were cross-sectional studies.

The sexual problems reported in the above studies mostly did not include any measures of sexual pain for men (with the exception of Li et al., 2020). Research among heterosexual-

identified women suggests that relationship satisfaction is strongly associated with less pain during sex (Boddi et al., 2015; Peixoto & Nobre, 2014). The lack of data on anal discomfort is an important limitation of the current literature as anal discomfort is a commonly reported sexual dysfunction among MSM (Hirshfield et al., 2010; Li et al., 2020; McMillan et al., 2017; Rosser et al., 1998), and thus very well might be impacted by relationship functioning.

Interplay of Mental Health, Relationship Factors, and Sexual Function/Satisfaction.

Little research has explored the interactions of mental health, relationship quality, and sexual function/satisfaction, and no research we are aware of has included racially and ethnically diverse YMSM. A cross-sectional study of depression and sexual function among male medical students (n=844) found that those who were in relationships had good erectile function and lower incidence of depression, and that those in satisfying relationships were at the lowest risk for depression (Smith et al., 2010). The same study also noted that identifying as gay was associated with more symptoms of depression (gay-identified men made up 13.0% of the sample).

Another study of heterosexual young adults observed that those in a relationship reported fewer symptoms of depression and anxiety, as well as higher sexual satisfaction (Carcedo et al., 2020). Also, sexual satisfaction was associated with lower levels of depression. This association was moderated by relationship status, such that those in a relationship saw a stronger association between low sexual satisfaction and higher levels of depression.

With this initial evidence of the protective effects of relationships and the research described above suggesting a high prevalence of sexual problems and heightened risk of mental health concerns among MSM, the interaction of these variables among YMSM is particularly important to examine. With increasing awareness of the high rates of need among young, racialized individuals who identify as sexual minorities for mental health (Lee et al., 2017; Mills et al., 2004), relationship (Chen et al., 2020; Whitton et al., 2019), and sexual health (Barbonetti et al., 2019) concerns, an understanding of the interaction of these factors would help to provide guidance to clinicians on potential areas for intervention.

Current Study

This project examined the association of self-reported depression symptoms and stress with sexual function, sexual satisfaction, and anal discomfort among a racially and ethnically diverse sample of YMSM in serious relationships. Further, we examine how relationship quality moderates this association. The aim of this study was to understand the interplay of mental health, relationship quality, and sexual concerns among an understudied population: racially and ethnically diverse YMSM.

We hypothesized that we would observe a main effect of mental health and relationship quality on sexual function and satisfaction, such that more self-reported symptoms of depression and stress and lower relationship quality would all be independently associated with more sexual problems and lower sexual satisfaction. Because we anticipate interactions between individual and relationship factors that would likely mask distinct main effects if all variables were included in a single analysis, we decided to examine main effects of individual and relationship factors separately. For the interaction between mental health and

relationship factors, we anticipated that better relationship quality would provide a protective effect and moderate the association between mental health and sexual concerns, such that participants who report higher quality relationships would see a significantly smaller or no association between mental health concerns and sexual concerns.

Method

Participants

Participants were part of an ongoing longitudinal cohort study of YMSM aimed at examining risk and protective factors for HIV and drug use (current $N > 1,200$). Inclusion criteria for cohort members included: 16–29 years old, assigned male at birth, English-speaking, and identified as a sexual or gender minority or had sex with a man in the past year. Details on the cohort study design have been reported elsewhere (Mustanski et al., 2019; Newcomb et al., 2018).

Analyses were cross-sectional; all data were taken from the timepoint in which all measures of interest were administered (i.e., wave 5, or 2-year follow-up). The analytic sample included participants who reported being in a current serious relationship at wave 5, excluding those who identified as transgender women (analytic $n = 348$). Participants in the analytic sample ranged from 18–31 years old ($M = 23.6$, $SD = 3.0$). Participants self-reported their race and ethnicity and identified as 23.3% Non-Hispanic White, 32.2% Non-Hispanic Black, 36.8% Hispanic/Latinx, and 7.8% Other. Participants mostly identified as gay (76.1%), with others identifying as bisexual (12.6%) and other (11.2%). The average length of relationship was 1.7 years ($SD = 1.6$, range 0.1 – 8.5). At wave 5, 20.4% of the analytic sample was HIV-positive, as determined by a combination laboratory-confirmed HIV testing and self-report for participants who completed surveys remotely. See Table 1 for a complete reporting of descriptive statistics for the study sample.

Procedure

Participants were recruited into the cohort through their participation in three previous cohorts, referral of peers, and referral of cohort members' current serious partners. Data collection began in 2015; these analyses used data collected through 2020. After providing informed consent, participants completed a battery of self-report measures assessing various constructs related to health and psychosocial factors hosted via REDCap (Harris et al., 2019), completed a social network interview, and provided a specimen for various biomedical outcomes (e.g., HIV/STI testing). Participants were compensated for each study visit.

Measures

Demographics.—Participants reported their age, race/ethnicity, sexual orientation, gender identity, HIV-status, relationship status, and relationship length.

Depression.—Participants completed the Patient-Reported Outcomes Measurement Information System (PROMIS) Depression – Short Form 8a (Pilkonis et al., 2011), an 8-item measure that includes questions about negative mood, views of self, and social

cognition. Participants were asked to rate how frequently they experienced each symptom over the past 7 days on a 5-point scale (1 = Never to 5 = Always). The PROMIS Depression – Short Form 8a showed excellent psychometric properties in the validation study, including an item-total correlation $r = .83$, $\alpha = .95$, one-factor confirmatory factor analysis supporting coherence (CFI = .99, TLI = .99, RMSEA = .11), and a very high correlation with the full item bank ($r = .98$). The use of the PROMIS Depression – Short Form 8a allows for comparison to the general population with t-score conversions. T-scores are reported in Table 1 for reference, although raw scores were used in analyses for consistency with sexual functioning variables of interest.

Stress.—Participants completed the Perceived Stress Scale (PSS; Roberti et al., 2006), a 10-item measure of the degree to which situations in one's life are appraised as stressful. Participants were asked to rate how frequently they experienced each concern in the past month on a 5-point scale (0 = Never to 4 = Very often). Items were summed for a total score. The PSS has shown strong psychometric properties, including item-total correlations ranging from .58 to .72 and $\alpha = .89$.

Relationship functioning.—Participants completed five different measures of relationship functioning.

Relationship satisfaction, trust, and commitment.: Single-item measures of relationship satisfaction, trust, and commitment were completed by participants. These items were derived from the Relationship Assessment Scale (Hendrick, 1988). A single-item measure of relationship satisfaction was used as it demonstrated strong correlation with the total scale ($r = .75$) and allowed for a more succinct measure of relationship functioning. Participants were asked to rate their relationship satisfaction, trust, and commitment on a 5-point scale (1 = Not at all to 5 = Very much).

Dyadic Adjustment Scale – Conflict.: The Conflict subscale of the Dyadic Adjustment Scale (DAS-Conflict) was administered as a measure of the frequency of conflict within the couple (Busby et al., 1995; Spanier, 1976). The DAS has demonstrated acceptable factor structure, supporting the Conflict subscale as a unique first-order factor (chi-square 149.44 ($p < .001$), GFI .95, RMR .050), and strong internal consistency ($\alpha = .90$). Participants were asked to rate how frequently they experienced conflict with their partner on a 6-point scale (0 = All the time to 5 = Never), such that higher scores indicate less conflict. To aid in interpretation, we reverse scored the scale; therefore, in the results presented here higher scores indicate more conflict.

Communication Skills Test – Negative interactions.: Participants' perceptions of negative relationship interactions were assessed using the negative communications subscale of the Communication Skills Test (Jenkins & Saiz, 1995). This measure assesses the frequency of negative interactions, including withdrawal, negative conflict, escalation, and invalidation. Previous research has shown this measure to have good internal consistency ($\alpha = 0.85$) and variability across men (Range: 1.00–5.38; SD = 0.78) and women (Range: 1.00–5.01; SD = 0.84; Whitton et al., 2007). Participants were asked to rate how true various statements about negative interactions are in their relationships on a 7-point scale (1 = Never happened, 4 =

Sometimes happened, 7 = Happened most of the time), such that higher scores indicate more negative interactions.

Sexual functioning.—Participant sexual functioning was assessed using 12 items from the PROMIS Sexual Function and Satisfaction Measures Brief Profile v1.0 – Male (PROMIS SFBP). The PROMIS SFBP assesses male sexual functioning in the past 30 days across five domains: global satisfaction with sex life, interest in sexual activity, erectile function, orgasm, and anal discomfort (Flynn et al., 2013; Weinfurt et al., 2015). The different domains comprising the PROMIS SFBP have shown strong psychometric properties in previous research, including strong content and construct validity (correlations with corresponding subscales of the International Index of Erectile Function range from .62 to .82), and reliability (Cronbach’s alpha ranging from .89 to .95). Mean scores were calculated for sexual interest, erectile function, and orgasm then summed to create a total Sexual Functioning score. Scores on the sexual satisfaction items were summed to create a total Sexual Satisfaction score. Responses to the anal discomfort items were summed to create a total Anal Discomfort score.

Participants were asked to rate their sexual functioning, satisfaction, and anal discomfort on a 5-point scale. The specific scale anchors changed with the question, but higher scores indicated better sexual function and satisfaction across all questions. For example, for the question “How often have you felt like you wanted to have sex?”, participants were given options from 1 = Never to 5 = Always. For the question “How difficult has it been for you to get an erection when you wanted to?”, participants were given options from 1 = Very to 5 = Not at all.

Data Analysis

Analyses were conducted in R version 4.0.3 using the nlme package version 3.1–149. We utilized a partially-nested mixed effects model to account for non-independence in the data, given that some participants were in serious relationships with each other (Candlish et al., 2018). Missing data were handled using restricted maximum likelihood (REML). REML uses all available data and produces relatively unbiased parameter estimates compared to maximum likelihood and listwise/pairwise deletion (Corbeil & Searle, 1976). The analytic sample varied depending on the outcome variable; 314 participants were included in sexual satisfaction models, 306 participants were included in sexual function models, and 199 participants were included in anal discomfort models. This approach is in line with REML, allowing for maximum power as well as reducing risk of bias in the exclusion of participants that do not respond to every item.

First, we used linear mixed-effects models to estimate the main effects of associations between depression, stress, and relationship quality variables with sexual function, sexual satisfaction, and anal discomfort. Next, we examined which independent variables remained significant in multivariate models with one model examining depression and stress together, and the other examining all relationship quality variables together. We decided against a single multivariate model for both the conceptual reasons described above, and because the inclusion of six independent variables with $N < 350$ would limit the power to detect

any significant effect. In univariate and multivariate analyses, we included age, sexual orientation, race/ethnicity, and relationship length as covariates. While we did not pre-register the inclusion of these covariates, we did examine the results without them and found no significant differences in the pattern of results.

Second, we examined moderating effects of relationship quality on associations between mental health variables (depression and stress) and sexual function, sexual satisfaction, and anal discomfort. In our moderation analyses, we again included age, sexual orientation, race/ethnicity, and relationship length as covariates. All continuous independent variables were mean-centered prior to entry into models. We included each variable in moderation analyses regardless of main effect significance due to the potential for a moderating effect masking a main effect. To reduce risk of Type I error, we adjusted the p value for each significance test in accordance with the Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995). We probed significant moderator effects using the procedure recommended by Preacher, Curran, & Bauer (2006); we examined relevant effects one standard deviation above and one standard deviation below the mean.

Results

Mean, standard deviation, and sample size for all variables included in analyses are presented in Table 1. Bivariate correlations are presented in Table 2. Overall, participants reported average levels of depressive symptoms (similar to the level of depressive symptoms reported by cohort members not in a relationship), levels of stress similar to those found in other studies (Cohen & Janicki-Deverts, 2012), few problems with sexual function, and being “quite a bit” to “very” satisfied with sex (Weinfurt et al., 2015). Furthermore, participants reported high levels of relationship satisfaction, trust, and commitment, and fighting or having negative interactions with their partners “rarely” to “occasionally” (Busby et al., 1995; Whitton et al., 2007). Depression and stress had a strong, positive correlation with each other, and small to moderate correlations with most relationship and sexual functioning variables. There was no correlation between depression or stress and relationship commitment. Sexual function and sexual satisfaction had a strong positive correlation; anal discomfort had a small negative correlation with sexual satisfaction but was not associated with sexual functioning. Sexual functioning and sexual satisfaction had small negative correlations with depression and stress, while anal discomfort had small, positive correlations with depression and stress. Sexual function and satisfaction also had small, positive correlations with relationship functioning. Anal discomfort was not associated with relationship functioning. There were small to moderate positive correlations among almost all relationship functioning variables, although there was no association between relationship conflict and commitment to the relationship.

Main Effects

Unstandardized regression coefficients, confidence intervals, and test statistics for main effects are presented in Table 3. In univariate analyses, depression and stress were both significantly associated with sexual functioning (depression: $B(SE) = -.05(.02)$, $p = .005$, 95% CI $[-.08, -.03]$, $R^2 = .04$; stress: $B(SE) = -.05(.02)$, $p = .007$, 95% CI $[-.08, -.02]$,

$R^2 = .04$), sexual satisfaction (depression: $B(SE) = -.08(.01)$, $p < .001$, 95% CI $[-.11, -.05]$, $R^2 = .10$; stress: $B(SE) = -.06(.01)$, $p < .001$, 95% CI $[-.09, -.03]$, $R^2 = .06$), and anal discomfort (depression: $B(SE) = .11(.03)$, $p = .020$, 95% CI $[.03, .20]$, $R^2 = .05$; stress: $B(SE) = .12(.03)$, $p = .016$, 95% CI $[.03, .20]$, $R^2 = .06$). Participants who reported more depression and more stress reported worse sexual functioning, lower sexual satisfaction, and more anal discomfort. In the multivariate analyses including depression and stress as independent variables, the only association that remained significant was that between depression and sexual satisfaction ($B(SE) = -.07(.02)$, $p < .001$, 95% CI $[-.11, -.04]$, $R^2 = .10$).

The main effects of some relationship functioning variables with sexual functioning and sexual satisfaction were significant. Specifically, participants who reported better sexual functioning endorsed higher relationship satisfaction ($B(SE) = .30(.12)$, $p = .026$, 95% CI $[.10, .50]$, $R^2 = .03$) and fewer negative interactions in their relationship ($B(SE) = -.29(.09)$, $p = .007$, 95% CI $[-.44, -.14]$, $R^2 = .04$). Additionally, participants who reported higher sexual satisfaction endorsed higher relationship satisfaction ($B(SE) = .59(.09)$, $p < .001$, 95% CI $[.39, .79]$, $R^2 = .10$), more commitment ($B(SE) = .51(.10)$, $p < .001$, 95% CI $[.34, .68]$, $R^2 = .07$), more trust ($B(SE) = .37(.09)$, $p < .001$, 95% CI $[.19, .56]$, $R^2 = .05$), and fewer negative interactions in their relationship ($B(SE) = -.41(.07)$, $p < .001$, 95% CI $[-.53, -.29]$, $R^2 = .09$). No relationship variables had significant main effects with anal discomfort. In the relationship functioning multivariate analyses, the associations between better sexual functioning and fewer negative relationship interactions ($B(SE) = -.31(.12)$, $p = .022$, 95% CI $[-.57, -.05]$, $R^2 = .51$), higher sexual satisfaction and higher relationship satisfaction ($B(SE) = .33(.13)$, $p = .030$, 95% CI $[.11, .54]$, $R^2 = .14$), and higher sexual satisfaction and fewer negative relationship interactions ($B(SE) = -.28(.09)$, $p = .012$, 95% CI $[-.43, -.13]$, $R^2 = .14$) all remained significant.

Moderation Effects

Unstandardized regression coefficients, confidence intervals, and test statistics for moderation effects are presented in Table 4. The association between stress and sexual satisfaction was moderated by relationship satisfaction ($B(SE) = .04(.02)$, $p = .015$, 95% CI $[.02, .07]$, $R^2 = .15$) and commitment ($B(SE) = .05(.02)$, $p = .016$, 95% CI $[.01, .09]$, $R^2 = .14$). Closer examination of the moderations indicated that higher relationship satisfaction and commitment reduced the relationship between stress on sexual satisfaction (see Figures 1a and 1b, respectively).

Relationship satisfaction also trended toward moderation of the association between depression and sexual functioning ($B(SE) = -.04(.02)$, $p = .045$, 95% CI $[-.07, -.01]$, $R^2 = .06$). When alpha was adjusted to reduce risk of Type I error, this result dropped to non-statistical significance. However, we decided to include the trend in our results as it approaches significance. In closer examination of this effect, higher relationship satisfaction exacerbated the negative relationship between depression and sexual functioning (see Figure 2).

Discussion

The purpose of this study was to examine the interplay between sexual function and satisfaction, relationship quality, and mental health concerns among a racially and ethnically diverse sample of YMSM in committed relationships. This study fills several gaps in the literature. First, the vast majority of studies on the sexual health of YMSM focus on HIV and “risky” sexual behavior. Far fewer have examined sexual functioning and satisfaction, both of which are central to individual and couple wellbeing. Further, this study provides a nuanced consideration of how multiple contextual factors at the individual and interpersonal level may interact to impact sexual functioning, rather than focusing exclusively on individual predictors (i.e., main effects) of sexual function.

As expected, participants in our sample with higher self-reported depression and stress also reported more sexual problems, lower sexual satisfaction, and more anal discomfort. On the whole, this finding is in line with the dual control model theory and prior research with heterosexual men and older MSM: higher self-reported stress and depression symptoms are linked with lower ratings on sexual health and satisfaction (Bancroft et al., 2003; Hirshfield et al., 2010; Rosser et al., 1998; Smith et al., 2010; Tutino et al., 2018; Ventus et al., 2017). This may be related to the direct symptoms of depression and stress (e.g., anhedonia, fatigue), the treatment of depression (i.e., SSRI's), distress resulting from prolonged sexual dysfunction, a general internalizing distress factor (Forbes & Schniering, 2013), and/or the inhibitory impact of stress on sexual response (Bancroft et al., 2005).

We also found that relationship quality variables were more strongly associated with sexual satisfaction than sexual function, and not predictive of anal discomfort. Again, this was in line with our hypotheses and prior research with heterosexual men and MSM (Boddi et al., 2015; Li et al., 2019). Our findings suggest that even when YMSM are experiencing few (or no) problems with their sexual function, they still may have low sexual satisfaction related to having low satisfaction with or high conflict in their relationship. Prior research on anal discomfort suggests that it is most prevalent among young and single MSM (Hirshfield et al., 2010). This is the first study to consider relationship quality as a potential contributor to anal discomfort. It is possible that simply being in a relationship is protective against anal discomfort because YMSM have the opportunity to experiment with receptive anal sex in a more comfortable and emotionally supportive context, in line with the findings of Li et al (2020). It is also possible that those who experience anal discomfort self-select into relationships in which their partners prefer to be in the receptive role, thereby optimizing sexual satisfaction. In our sample, participants mostly reported little to no anal discomfort, and it is unclear if the lack of significant results is due to a lack of association, or to a lack of variability in participant responses. Further research is needed to more fully understand how anal discomfort may be associated with relationship status and quality.

When mental health and relationship quality variables were examined in multivariate analyses for their association with sexual health outcomes, only a few remained significant (depression was associated with sexual satisfaction, fewer negative interactions were associated with better sexual function and higher sexual satisfaction, and higher relationship satisfaction was associated with higher sexual satisfaction). It is possible that the moderation

of some of the associations made the main effect undetectable when more variables were included in the main effect analysis. It is also possible that small sample size with a large number of independent variables (e.g., anal discomfort analyses had $n = 199$) limited the power to detect significant results. Furthermore, it is possible there is some overlap in the constructs being measured (e.g., depression and stress), and much of the variance is accounted for by just one of the variables. Bi-variate correlational analyses do not indicate concerns for multicollinearity, and so we do not believe this is of significant concern for the overall conclusions of the study.

The association between stress and sexual satisfaction was moderated by relationship satisfaction and commitment. Relationship satisfaction also approached significance as a moderator of the association between depression and sexual function. When we examined the source of the interactions, we saw almost no association between stress and sexual satisfaction for those with high relationship satisfaction and high commitment, and a strong association between stress and sexual satisfaction for those with low relationship satisfaction and low commitment, as expected. This suggests that highly satisfying and committed relationships can buffer against the negative impact of stress on sexual satisfaction (or, inversely, reduce the degree to which low sexual satisfaction contributes to overall stress) in YMSM. Having a supportive and trusted other with whom to share negative emotional experiences can help to manage the effects of stress. This may be particularly true when stress is related to experiences with stigma and discrimination, and one's partner is able to understand and empathize with those experiences. When sex occurs in the context of a satisfying and committed relationship, it can function as stress relief. This is in line with prior research showing that relationship satisfaction is a major contributor to associations between anxiety and sexual functioning (Smith et al., 2010).

Contrary to our expectations, we saw a stronger association between depression and sexual functioning for those with high relationship satisfaction. This finding suggests that YMSM who are depressed and in a highly satisfying relationship are more likely to experience sexual problems. While this is contrary to some prior research (e.g., Smith et al., 2010), we believe it may be related to some features of depression. Both symptoms of depression (e.g., little interest in pleasurable activities) and treatments for depression (i.e., SSRIs) contribute to difficulties with sexual functioning. Prior research has shown that some men, and especially young men, actually report an increase in sexual activity when they are depressed (Bancroft et al., 2003; Tutino et al., 2018). It is possible that being thwarted by sexual dysfunction while experiencing a desire for increased sexual contact and intimacy was particularly distressing for the young men in this study.

It is also possible that the exacerbating effect of being in a satisfying relationship is related to the nature of sex when in a satisfying, serious relationship. The motivation for and experience of sex when in a serious relationship can be more intimate and focused on interpersonal connection than when single, and this increased sexual intimacy may be more difficult to reach when depressed. Young, single MSM tend to have more casual sex, which may be easier to engage with even when depressed, as it provides a physical connection without taxing emotional systems that are already strained when experiencing depressive symptoms. In fact, the two studies cited above finding increased sexual activity

when young men were depressed primarily included single men (Bancroft et al., 2003; Tutino et al., 2018). Furthermore, depression not only impacts sexual response, but can also impact one's social connectedness. Experiencing social isolation and disconnection from others as part of depression may make it more difficult for men in relationships to have sex that is satisfying to both partners, when they and their partners are used to sex that is highly intimate and connected. In short, the impact of depression on sexual functioning coupled with expectations of intimate sex when in a serious relationship may combine to make sexual problems feel particularly problematic in the context of a loving, satisfying relationship.

We can also interpret these results using the theoretical basis of the dual control model. Sexual satisfaction is not a direct effect of the sexual inhibition and excitation systems and can be present with or without a physiological sexual response. Therefore, the association between sexual satisfaction and overall stress may be more malleable in response to protective factors, such as high relationship satisfaction, compared to sexual functioning. Prolonged difficulties with sexual function (overactivation of sexual inhibition system, under activation of sexual excitation system) may contribute to depressive symptoms (feeling like you've let yourself or loved ones down, having difficulty finding pleasure in things you used to enjoy). When this pattern occurs in the context of a highly satisfying relationship, the distress of being less sexually responsive may exacerbate the activation of the sexual inhibition system.

Implications

This study contributes meaningful information on ways in which mental health concerns, relationships, and sexual problems and satisfaction are related to each other in a diverse sample of YMSM. The findings support the complexity of the interactions among these variables and underscore the importance of careful assessments of the different facets of presenting problems. For YMSM presenting with relationship concerns or sexual dysfunction, it will be vitally important to assess stress levels and symptoms of depression. Additionally, YMSM presenting with depression or stress may be experiencing sexual dysfunction that is either exacerbated or ameliorated by the quality of their committed relationships. Targeting relationship satisfaction and commitment may be an effective way to improve sexual satisfaction in YMSM who are reporting high levels of stress. It may also be helpful to provide concrete tools and education on having effective and satisfying receptive anal sex, as has been done for young gay men in the Queer Sex Ed intervention (Mustanski et al., 2015). Strategies for effective receptive anal sex is rarely directly discussed with YMSM, and it is possible this would broadly increase sexual and relationship satisfaction. An important distinction to make in assessment will be the difference between frequency of sexual activity, presence of sexual dysfunction, and satisfaction with sexual experiences.

Limitations

A primary limitation of the study is the use of a cross-sectional design. Because the assessment of sexual functioning only occurred during specific timepoints, we were unable to examine causal or predictive relationships between mental health concerns and sexual functioning and satisfaction. Based on prior research, we would expect to see a bi-

directional relationship; however, this research has not been done with diverse samples and needs replication for generalizability. An important influence on sexual health, relationship quality, and mental health in YMSM is minority stress. We did not include minority stress in this study due to the already complex set of variables included in the regression models. Another limitation is in the relative lack of variability in terms of sexual functioning and satisfaction. While the sample is diverse in terms of demographics, it is overall a sexually healthy and satisfied group of participants and likely does not represent the full range of sex-related outcomes. It is possible in a clinical sample that more relationship factors would moderate the association between sexual and mental health; however, it is also possible that at higher levels of distress or dysfunction, positive relationship factors are insufficient to protect against sexual dysfunction. Further exploration of these questions in a sample with clinically significant sexual health concerns would provide more relevant insights on how to address relationship and sexual health concerns when MSM present for treatment. Finally, we did not pre-register our hypotheses or analytic plan for this study, which would have strengthened the methodological rigor.

Conclusions

To our knowledge, this study was the first to examine the interplay between sexual function and satisfaction, relationship quality, and mental health concerns among a racially and ethnically diverse sample of YMSM. Our results both support prior research that strong relationships can mitigate the link between mental health concerns and sexual satisfaction, and it provides new evidence that the impact of depression on sexual functioning may be particularly distressing for individuals in committed relationships. Attention to YMSM's mental health, relationship quality, and sexual functioning and satisfaction is important, as all these factors influence quality of life.

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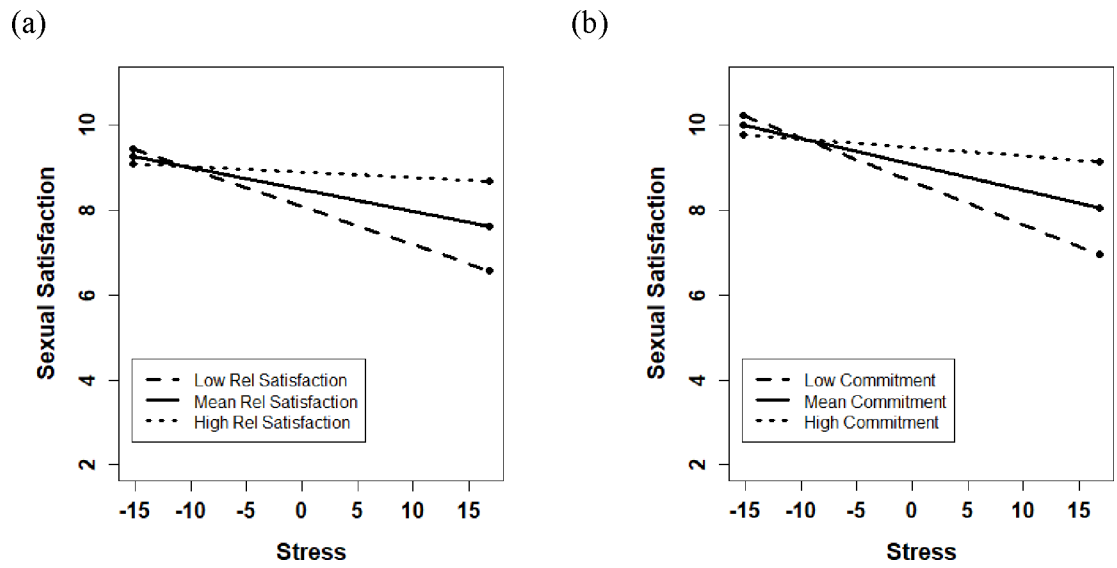


Figure 1. Regression lines for relationship between stress and sexual satisfaction as moderated by (a) relationship satisfaction and (b) commitment.
 Note: Values reflecting one standard deviation above and below the mean were used as conditional values of the moderators.

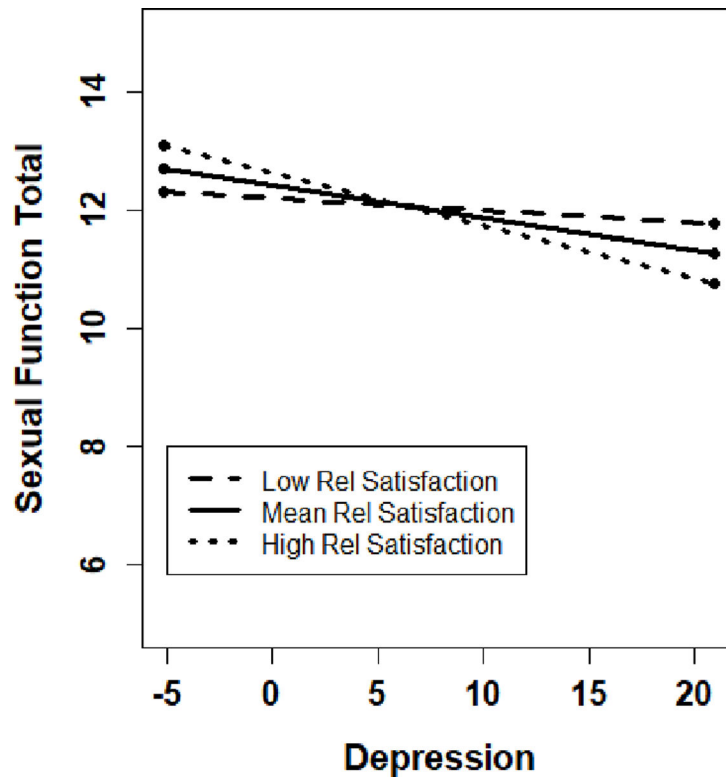


Figure 2. Regression lines for relationship between depression and sexual function as moderated by relationship satisfaction.

Note: Values reflecting one standard deviation above and below the mean were used as conditional values of the moderator.

Table 1.

Descriptive statistics.

	% or mean	n or (SD; range)	N
<i>Demographics</i>			
Age	23.6	(3.0; 18.0-31.7)	348
<i>Race/ethnicity</i>			
Non-Hispanic white	23.3%	81	348
Non-Hispanic black	32.2%	112	
Hispanic/Latino	36.8%	128	
Other	7.8%	27	
<i>Sexual orientation</i>			348
Gay	76.1%	265	
Bisexual	12.6%	44	
Other	11.2%	39	
HIV-positive (wave 5)	20.4%	71	348
Relationship length (years)	1.7	(1.6; 0.1-8.5)	348
Depression	48.2	(9.5; 38.2-71.7)	348
Stress	15.2	(6.4; 0.0-32.0)	348
<i>Relationship functioning</i>			
Negative interactions	2.5	(1.2; 1.0-7.0)	327
Conflict	3.2	(2.1; 0.0-10.0)	327
Trust	4.3	(1.0; 1.0-5.0)	348
Commitment	4.5	(0.8; 1.0-5.0)	348
Relationship satisfaction	4.3	(0.9; 1.0-5.0)	348
<i>Sexual health</i>			
Sexual function total score ^a	12.6	(1.9; 5.3-15.0)	306
Erectile function	4.7	(0.6; 1.7-5.0)	313
Sexual interest	3.6	(1.0; 1.0-5.0)	327
Orgasm satisfaction	4.3	(0.9; 1.0-5.0)	316
Anal discomfort	7.1	(3.0; 4.0-20.0)	199
Sexual satisfaction	8.8	(1.6; 2.0-10.0)	314

^aTotal sexual functioning scores were calculated by summing mean scores on erectile function, sexual interest, and orgasm satisfaction. Mean raw scores of erectile function, sexual interest, and orgasm satisfaction are presented. Total raw scores of anal discomfort and sexual satisfaction are presented.

Table 2.

Bivariate correlation matrix.

	1	2	3	4	5	6	7	8	9	10
n	348	348	327	327	348	348	348	316	314	199
1. Depression	--									
2. Stress	.63 ^{***}	--								
3. Negative interactions	.28 ^{***}	.26 ^{***}	--							
4. Conflict	.19 ^{***}	.14 ^{**}	.51 ^{***}	--						
5. Trust	-.16 ^{**}	-.15 ^{**}	-.42 ^{***}	-.28 ^{***}	--					
6. Commitment	-.09	-.10	-.22 ^{***}	-.08	.46 ^{***}	--				
7. Relationship Satisfaction	-.27 ^{***}	-.23 ^{***}	-.41 ^{***}	-.24 ^{***}	.58 ^{***}	.56 ^{***}	--			
8. Sexual function total	-.16 ^{**}	-.16 ^{**}	-.17 ^{**}	-.03	.10	.12 [*]	.14 [*]	--		
9. Sexual satisfaction	-.32 ^{***}	-.23 ^{***}	-.29 ^{***}	-.15 ^{**}	.23 ^{***}	.26 ^{***}	.31 ^{***}	.55 ^{***}	--	
10. Anal discomfort	.24 ^{***}	.24 ^{***}	.05	.02	.10	-.07	-.06	-.11	-.16 [*]	--

 $p < .001$;**
 $p < .01$;*
 $p < .05$

Mixed-effects regression results estimating the main effects of depression, stress, and relationship quality on sexual function, sexual satisfaction and anal discomfort

Table 3.

	Sexual function (n=306)			Sexual satisfaction (n=314)			Anal discomfort (n=199)					
	B(SE) ^a	CI ^b	t	p	B(SE)	CI	t	p	B(SE)	CI	t	p
Depression	-.05(.02)	-.08, -.03	-3.25	.005	-.08(.01)^c	-.11, -.05	-6.35	<.001	.11(.03)	.03, .20	3.36	.020
Stress	-.05(.02)	-.08, -.02	-3.05	.007	-.06(.01)	-.09, -.03	-4.45	<.001	.12(.03)	.03, .20	3.56	.016
Negative interactions	-.29(.09)^c	-.44, -.14	-3.13	.007	-.41(.07)^c	-.53, -.29	-5.70	<.001	.14(.18)	-.35, .63	0.78	.480
Conflict	-.03(.05)	-.14, .08	-0.56	.586	-.11(.04)	-.21, -.02	-2.65	.019	.04(.11)	-.25, .33	0.39	.713
Trust	.18(.11)	-.06, .42	1.63	.124	.37(.09)	.19, .56	4.34	<.001	.35(.21)	-.23, .93	1.66	.172
Commitment	.27(.13)	.00, .55	2.08	.054	.51(.10)	.34, .68	4.96	<.001	-.17(.26)	-.89, .55	-0.66	.543
Relationship satisfaction	.30(.12)	.10, .50	2.45	.026	.59(.09)^c	.39, .79	6.24	<.001	-.20(.25)	-.89, .49	-0.81	.462

Notes: All statistics presented here represent univariate linear regression models. Bolded statistics indicate statistical significance (p<.05)

^aUnstandardized regression coefficient (standard error)

^b95% Confidence interval of unstandardized regression coefficient

^cDenotes models for which the effect remained significant in multivariate analyses (one multivariate analysis included depression and stress; the other included all relationship functioning variables).

Table 4.

Mixed-effects regression results estimating the moderating effect of relationship quality on the association between depression, stress and sexual function, sexual satisfaction and anal discomfort.

	Sexual function (n=306)			Sexual satisfaction (n=314)			Anal Discomfort (n=199)					
	B(SE) ^a	CI ^b	t	p	B(SE)	CI	t	p	B(SE)	CI	t	p
Depression x												
Negative interactions	.00(.01)	-.03, .03	0.19	.853	-.01(.01)	-.03, .02	-0.54	.598	.01(.02)	-.09, .11	0.42	.714
Conflict	-.01(.01)	-.02, .01	-0.79	.440	.00(.01)	-.02, .01	-0.66	.521	.01(.01)	-.05, .26	0.85	.485
Trust	-.02(.02)	-.05, .00	-1.45	.170	-.01(.01)	-.03, .00	-1.24	.239	-.02(.32)	-.13, .09	-0.84	.490
Commitment	<.01(.02)	-.04, .04	0.03	.979	-.01(.02)	-.04, .03	-0.44	.665	.02(.05)	-.06, .10	0.44	.706
Relationship satisfaction	-.04(.02)	-.07, -.01	-2.20	.045	-.01(.01)	-.03, .02	-0.43	.677	-.01(.03)	-.15, .14	-0.25	.824
Stress x												
Negative interactions	-.01(.01)	-.04, .02	-0.92	.374	-.01(.01)	-.03, .00	-1.36	.200	.02(.03)	-.09, .14	0.88	.471
Conflict	-.01(.01)	-.02, .00	-1.20	.249	.00(.01)	-.02, .01	-0.67	.518	.00(.01)	-.06, .06	-0.14	.899
Trust	-.01(.02)	-.05, .04	-0.44	.668	.02(.02)	-.01, .05	1.24	.237	-.02(.04)	-.19, .15	-0.49	.673
Commitment	.03(.02)	-.02, .08	1.20	.250	.05(.02)	.01, .09	2.79	.016	.02(.05)	-.18, .21	0.36	.756
Relationship satisfaction	-.01(.02)	-.05, .03	-0.53	.606	.04(.02)	.02, .07	2.84	.015	-.01(.04)	-.19, .17	-0.18	.874

Notes: Each row presents separate linear regression models. Bolded statistics indicate statistical significance (p<.05).

^aUnstandardized regression coefficient (standard error)

^b95% confidence interval of unstandardized regression coefficient

[#]Trend toward significance; drops below statistical significance when adjusting to reduce risk of Type I error