PAIN

Temporal Relationships Between Pain During Intercourse (PDI), Loneliness, and Depressive Symptoms Among Women

Madison E. Stout, MS, and Misty A.W. Hawkins, PhD

ABSTRACT

Background: Painful sex can lead to increased psychological distress, including major depressive disorder, and the experience of loneliness may explain this association.

Aims: We aimed to investigate loneliness as a mediator between painful sex and depressive symptoms and hypothesized that women who experienced greater pain during intercourse (ie, more severe and more frequent pain) would endorse higher rates of loneliness and, in turn, higher rates of depressive symptoms at a 6-month follow-up.

Methods: Participants were 148 adults who were assigned female at birth (78.4% white, 77% partnered, 31.14 ± 10.9 years old) and completed an online, anonymous survey including the Female Sexual Function Index (FSFI), UCLA Loneliness Scale-3 (ULS), and demographic information.

Main Outcome Measure: Depressive symptoms, measured via the Patient Health Questionnaire-8 (PHQ8) at baseline (T1) and 6-month follow-up (T2) were used as the outcomes of the present study.

Results: Painful sex and ULS at T1 were significantly correlated with each other and with PHQ8 at T1 (r = 0.590). However, change in PHQ8 from T1 to T2 was not significantly correlated with ULS (r = 0.024) or any other key study variables, indicating that that ULS was not a significant mediator of the relationship between painful sex at T1 and change in PHQ8 (standardized indirect effect = 0.011; 99% CI = −0.114 to 0.188).

Conclusion: These findings are consistent with previous studies highlighting that painful sex is related to depressive symptoms through loneliness cross-sectionally, suggesting that future treatments for depressive symptoms among women who experience painful sex might target loneliness. **Stout ME, Hawkins MAW. Temporal Relationships Between Pain During Intercourse (PDI), Loneliness, and Depressive Symptoms Among Women. Sex Med 2021;9:100444**.

Key Words: Loneliness; Depressive Symptoms; Dyspareunia; Genitopelvic Pain/Penetration Disorder

INTRODUCTION

Genital discomfort or pain during intercourse (PDI) is an aspect of sexual dysfunction, affecting between 6.5% and 45% of older women and 14% and 34% of younger women.[1] When a woman's vaginal discomfort during sex reaches severe and psychologically distressing levels, she may meet the criteria for a sexual dysfunction disorder. The DSM-IV-TR described 2 female sexual function disorders involving genital pain: Dyspareunia and Vaginismus,[2] but symptoms of the two disorders often overlapped.[3] For this reason, the DSM-5 merged them into one: Genitopelvic Pain/Penetration Disorder (GPPD).[4] Women who experience painful sex, regardless of whether they have sought or received a diagnosis, are more likely to suffer from general psychological distress and, in particular, increased depressive symptoms.[5,6]

Several cross-sectional studies reveal that genital discomfort during sex was related to increased depressive symptoms[7−14]; but some contrasting results show little to no direct relationship between painful intercourse (and/or vaginal/vulvar complaints) and depressive symptoms.[15,16] In longitudinal studies, painful sex has been shown to predict increases in clinical depression or depressive symptoms.[17] However, the directionality remains unclear. For instance, Khandker et al[6] found that vulvodynia

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Department of Psychology, Oklahoma State University, Stillwater, OK, USA

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increased the risk of new and recurrent onset of a mood disorder but also found that a diagnosed depressive disorder was an independent predictor for developing vulvodynia. A strong cross-sectional relationship between painful sex and depressive symptoms has been previously documented, but the directionality and potential mechanisms of this relationship have yet to be clarified.

One mechanistic factor that may explain the relationship between painful sex and depressive symptoms is loneliness. Loneliness, or the perceived lack of social connectedness, has important psychological and physical health implications.[18,19] The current study adopted the perceived social isolation definition for loneliness, rather than objective social isolation. The relationship between loneliness and depression is well-established. Longitudinal studies show that loneliness predicted increases in depressive symptoms among children, adolescents, college freshmen, adults, and the elderly.[20–22]

Although women who experience pain during sex and/or loneliness may be more likely to experience depressive symptoms, the relationship between painful sex and loneliness remains unclear. Currently, only one study has examined the relationship between painful sex and loneliness. Stout et al[14] found a positive cross-sectional correlation between pain during intercourse and loneliness, and analyses suggested painful sex was linked to depressive symptoms through loneliness (ie, indirect effects analysis). However, cross-sectional data cannot provide true tests of mediation. Thus, the present study expanded these indirect effects findings using longitudinal data to elucidate the temporal relationships between painful intercourse and depressive symptoms with loneliness as a mediating variable.

Despite the lack of extant prospective examinations of loneliness in relation to painful sex, this current work is warranted given the theoretical links between painful sex and loneliness that have already been documented. In their qualitative study, Connor et al[23] identified a common theme among women dealing with vulvar pain and their male partners: these women felt socially isolated and less connected to their partners. Research suggests that women have difficulty communicating about painful intercourse with sexual and romantic partners,[24] close friends or acquaintances,[25] and with physicians.[26] If women are unable to share their experiences with important others, whether due to actual or anticipated social consequences, these barriers may mean they might not receive the medical care or social support they need, and thus increase their feelings of perceived social isolation (loneliness).

In sum, the present study poses the following overarching question: Is the relationship between PDI and subsequent depressive symptoms explained by loneliness? This study uses a longitudinal design to advance the literature by expanding upon the findings from previous work on the painful sex-loneliness-depression relationship, including a cross-sectional pilot study.[14] *A priori* hypotheses were: H_1: PDI, loneliness, and depressive symptoms would be positively correlated with one another at baseline (T1); H_2: PDI, loneliness, and depressive symptoms (T1) would be positively correlated with 6-month follow-up depressive symptoms at Time 2 (T2) and with change in depressive symptoms (T2-T1); and H_3: loneliness would mediate the relationship between baseline PDI and change in depressive symptoms.

METHOD

Participants

Participants (n = 148) were recruited from Amazon Mechanical Turk (Mturk) and SONA, both online research participation platforms. Participants had to meet the following inclusion criteria: (i) assigned female at birth, of any gender identity, (ii) 18 years of age or older, (iii) have experienced consensual, vaginally penetrative sexual intercourse in the past 4 weeks, and (iv) can read English fluently. Throughout the present study, sexual intercourse was defined as follows: Activity with another individual in which the vaginal cavity is penetrated by an object or body part for sexual purposes. Therefore, nonconsensual sex, acts of self-stimulation/masturbation, or penetration by nonsexual objects (ie, tampons) were not considered consensual sexual intercourse. Participants first completed demographic and sexual functioning items, and the remainder of the scales were presented in random order.

Procedure

Data were collected via an online survey on Mturk in addition to SONA for a variety of reasons. First, the sensitive nature of the questions and topics covered might have deterred students in the SONA pool from participating and thus limiting the number of respondents. Further, symptoms of vulvodynia tend to begin between the ages of 18 and 25 years.[27] Given that SONA participants are largely first-year undergraduates (eg, average participant age is typically around 19 years),[28] an Mturk sample was more likely to increase diversity and generalizability.

Participants accepted a HIT (or Human Intelligence Task) through Mturk or signed up on SONA for a two-part online confidential Qualtrics survey. Online consent was obtained. Baseline surveys were completed (T1), and approximately 6 months later participants completed T2 surveys. After completing the baseline T1 survey, Mturk participants were compensated $3.00, while SONA participants received credit for a 1-hour study. For the T2 survey, MTurk participants were compensated $5.00, and SONA participants were entered into a drawing to win a $25.00 Amazon gift card. All procedures were approved by the university's Institutional Review Board.

Measures

Pain During Intercourse. The Female Sexual Function Inventory (FSFI)[29] includes a 3-item subscale that measures vaginal discomfort during and following intercourse in the last 4

weeks. Items in this inventory are summed to provide a total value for sexual functioning, where higher scores reflect higher levels of functioning, with pain/discomfort values ranging from 3 to 15. Items on the pain subscale of the FSFI measure the frequency of discomfort or pain during and following intercourse (1 = almost always or always to 5 = almost never or never) as well as the degree of pain during or following intercourse (1 = very high to 5 = very low or none at all). Participants who reported that they had not had sexual intercourse (as defined by the current study) in the past 4 weeks did not receive this inventory. For analyses, the discomfort items were reverse coded, so that higher total scores represent more severe and/or frequent discomfort. In the present sample, the pain subscale of the FSFI demonstrated good internal consistency (α = 0.83).

Depressive Symptoms. The 8-item Patient Health Questionnaire (PHQ8)[30] was used as a measure of depressive symptoms. Participants rated from (0 = not at all to 3 = nearly every day) the frequency at which they experienced depressive symptoms in the past 2 weeks, including loss of interest, feeling down, sleep disturbance, loss of energy, appetite changes, feeling like a failure, difficulty concentrating, and psychomotor agitation or retardation. The responses were summed with a possible range of 0 to 24, where higher values represent more severe depressive symptoms. Additionally, the PHQ8 included one item assessing how difficult the listed depressive symptoms interfered with their daily life tasks, in other words, how interfering these symptoms have been, from (0 = not at all difficult to 3 = extremely difficult). None of the items assess for loneliness, social connectedness, or social isolation so multicollinearity concerns are reduced. In the present sample, this scale demonstrated good internal consistency (α = 0.90).

Of note, the PHQ8 was administered as baseline and follow-up to account for the influence of depressive symptoms at T1 on follow-up depression at 6-month follow-up. Change in depression score was calculated by subtracting T1 from T2 (change = T2-T1), such that a negative score would indicate a decrease in depressive symptoms.

Loneliness. The UCLA Loneliness Scale (ULS) version 3 is a 20-item self-report measure of loneliness.[31] Participants rated the frequency at which they experienced feelings of loneliness and social connectedness (1 = never to 4 = always). After reverse scoring nine of the items, responses were summed for a total score with a possible range of 20−80, with higher scores indicating greater loneliness. The ULS has shown good reliability in college students (α = 0.92), nurses (α = 0.94), and the elderly (α = 0.89).[31] This scale demonstrated good internal consistency in the present sample (α = 0.96).

Covariates and Auxiliary Variables. Participants were asked demographic questions, including age, gender identity, and race/ethnicity. Race was selected as an important covariate given that research suggests that patients with chronic pain are perceived and treated differently in medical settings based on race. Specifically, Black patients and patients of color often receive poorer quality care than white patients.[32,33] There are also psychosocial factors (ie, rumination) that play a role in both race and sex differences in pain perception and appraisals of control that are likely impacted by inadequate care or potentially harmful interactions with physicians.[34] The 7-item Generalized Anxiety Disorder (GAD7) was used to measure symptoms of anxiety.[35] Age and anxiety were used as auxiliary variables.

DATA ANALYSIS

Statistical Analyses

First, descriptive statistics were collected, including means and standard deviations of the primary study variables (ie, PDI, loneliness, and depressive symptoms). Then, bivariate correlations were conducted to test hypotheses that baseline PDI, loneliness, and depressive symptoms are positively correlated (H_1) and that baseline PDI, depression, and loneliness at T1 are positively correlated with follow-up depressive symptoms at T2 and change in depressive symptoms from T1 to T2 (H_2).

A mediation analysis was conducted using Mplus, version 8.0 (Muthén & Muthén, Los Angeles, CA, USA)[36] to test the hypothesis that loneliness mediated the relationship between baseline PDI and change in depressive symptoms (H_3). To do so, depressive symptoms were measured at 2 different times, 6 months apart, and a change variable was computed (T2-T1) and used as the primary outcome for all subsequent analyses. The overall mediated effect was tested, which represents the total indirect effect. The analysis was conducted with 5,000 bootstrapped re-samples. All variables were modeled as measured variables. Two variables were chosen *a priori* based on recommendations from Enders (Enders, 2010) to serve as auxiliary variables in the maximum likelihood missing data approach in all analyses: age and GAD7.

RESULTS

Data Cleaning and Validation

All data were reviewed and cleaned in SPSS version 25.0 (IBM Corp., Armonk, NY, USA) before analyses were conducted in Mplus, version 8.0 (Muthén & Muthén)[36] to ensure that they were complete and meet assumptions for a simple mediation analysis. A total of 343 individuals responded to the survey, and a total of 195 records were eliminated from the dataset for not meeting eligibility criteria or for invalid responding. Upon final data cleaning, a complete sample of 148 individuals with valid responding was retained for analyses. Missing data at time 2 due to attrition were computed with a maximum likelihood approach in Mplus, version 8.0 (Muthén & Muthén).[36]

Table 1. Baseline differences in sampling group

	Sampling group			
	Total (*N* = 148)	MTurk (*n* = 96)	SONA (*n* = 52)	*P*
Demographic covariates and auxiliary variables				
Age	31.14 (10.9)	36.94 (8.5)	20.42 (5.2)	<.001
Race/Ethnicity				
white/Caucasian	116 (78.4%)	77 (80.2%)	39 (75.0%)	
More than one race	13 (8.8%)	6 (6.3%)	7 (13.5%)	
Black/African American	9 (6.1%)	7 (7.3%)	2 (3.8%)	
Latinx	4 (2.7%)	3 (3.1%)	1 (1.9%)	
Asian	3 (2.0%)	3 (3.1%)	0 (0.0%)	
American Indian/Alaska native	2 (1.4%)	0 (0.0%)	2 (3.8%)	
Middle Eastern/North African	1 (0.7%)	0 (0.0%)	1 (1.9%)	
Relationship status - Partnered*	114 (77%)	88 (91.7%)	26 (50.0%)	<.001
Sexual orientation				
Heterosexual	132 (89.2%)	85 (88.5%)	47 (90.4%)	
Bisexual	13 (8.8%)	10 (10.4%)	3 (5.8%)	
Homosexual	2 (1.4%)	1 (1.0%)	1 (1.9%)	
Other sexuality	1 (0.7%)	0 (0.0%)	1 (1.9%)	
Highest level of education				<.001
High school or GED	21 (14.2%)	12 (12.5%)	12 (23.1%)	
Technical school	4 (2.7%)	3 (3.1%)	1 (1.9%)	
Some college/Associates degree	76 (51.3%)	42 (43.8%)	34 (65.3%)	
Bachelor's degree	34 (23.0%)	30 (31.3%)	4 (7.7%)	
Graduate degree	10 (6.8%)	9 (9.4%)	1 (1.9%)	
Generalized Anxiety Disorder-7	14.32 (6.9)	13.68 (6.9)	15.52 (6.7)	
Female Sexual Function Index — Pain Subscale	5.27 (3.2)	5.17 (3.3)	5.46 (3.1)	
Patient Health Questionnaire-8	13.38 (5.6)	12.85 (5.2)	14.37 (6.1)	
UCLA Loneliness Scale	39.85 (13.2)	41.54 (14.6)	36.73 (10.7)	.025

Note. Data are presented using M [SD] or n (%).
P-value for significant differences between MTurk or SONA sampling groups.
*Married, living with partner, or in a serious relationship.

Participants

Participants (n = 148) were all assigned female at birth who had participated in sexual intercourse in the past 4 weeks, were on average 31.14 ± 10.9 years old, 78.4% white, 89.2% heterosexual, 77% were partnered, and 97.8% identified as women (see Table 1). MTurk and SONA samples differed significantly on age, relationship status, and level of education, with MTurkers being older, more likely to be partnered, and having more education (see Table 1). As attrition was large in the present study between survey 1 (n = 148) and survey 2 (n = 83), we examined key differences between completers and non-completers. Notably, there were no significant differences in pain severity or frequency between sampling groups (Table 1) or between completers and non-completers.

On average at T1, participants endorsed low-to-moderate levels of PDI (mean = 5.27, SD = 3.2, range = 3.0−14.0), moderate levels of depressive symptoms (mean = 13.38, SD = 5.6, range = 0.0−24.0), and moderate levels of loneliness (mean = 39.85, SD = 13.2, range = 20.0−80.0). Change in depressive symptoms from T1 to T2 was a low increase on average (mean = 0.67, SD = 3.9), but varied widely with increases up to 9 points and decreases of up to 10 points, thereby showing adequate variability in the depression change score.

Hypothesis 1: Cross-Sectional Bivariate Associations

Greater depressive symptoms at T1 were highly positively correlated with greater loneliness at T1 (r = 0.590) with large effect sizes. Greater depressive symptoms at T1 were also positively correlated with greater PDI at T1 (r = 0.255) with a small-to-moderate effect size. Similarly, greater loneliness at T1 showed a moderately sized positive correlation with greater PDI at T1 (r = 0.325). In sum, all correlations at T1 suggest medium-to-large effects between depressive symptoms, loneliness, and PDI when examined cross-sectionally. Correlation results are presented in Table 2.

Hypothesis 2: Prospective Bivariate Associations

Examining the longitudinal correlations, greater depressive symptoms (r = 0.779), loneliness (r = 0.568), and PDI

Table 2. Bivariate associations between key study variables

Variable	1	2	3	4
1. Depressive symptoms (PHQ8) T1	-			
2. Depressive symptoms (PHQ8) T2	.779	-		
3. Depressive symptoms change (PHQ8) T2-T1	-.242	.419	-	
4. Loneliness (ULS) T1	.590	.568	.024	-
5. Pain during intercourse (PDI) T1	.255	.272	.051	.325

Note. PDI = Pain During Intercourse; PHQ8 = Patient Health Questionnaire; T1 = Time 1; T2 = Time 2; ULS = UCLA Loneliness Scale.

(r = 0.272) at T1 were all positively correlated with greater depressive symptoms at T2 (medium-to-strong effect sizes). When examining change in depressive symptoms from T1 to T2, depressive symptoms at T1 were negatively correlated with depression change score, such that higher T1 depression was associated with smaller changes in depressive symptoms over time (r = −0.242). In contrast, neither greater loneliness nor PDI at T1 was correlated with change in depressive symptoms (rs = 0.024; 0.051, respectively). In sum, greater depressive symptoms at baseline were associated with smaller changes in follow-up depressive symptoms, and PDI and loneliness were not linked to depression change scores. Results are presented in Table 2.

Hypothesis 3: Mediation Analyses

Results of the mediation analysis (Figure 1) indicated that loneliness accounted for 10.1% of the variance in the model. More severe baseline PDI (past 4 weeks) was associated with greater loneliness (β = 0.318; 99% CI = 0.117−0.514). Loneliness was not significantly associated with change in depressive symptoms at 6-month follow-up (β = 0.034; 99% CI = −0.315 to 0.494). Baseline PDI (past 4 weeks) was not indirectly related to greater follow-up depressive symptoms through loneliness (standardized indirect effect = 0.011; 99% CI = −0.114 to 0.188). The relationship between baseline PDI (past 4 weeks) and follow-up depressive symptoms was not significant (standardized direct effect = −0.040; 95% CI = −0.554 to 0.441).

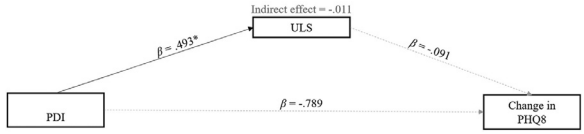

Figure 1. Standardized results of the longitudinal analysis of loneliness as a mediator between pain during intercourse and change in depressive symptoms. Note. *99% confidence interval does not include zero; PDI = pain during intercourse; PHQ8 = Patient Health Questionnaire-8 (depressive symptoms) 452 × 154 mm (96 × 96 DPI); ULS = UCLA Loneliness Scale.

Cross-Sectional Data Sensitivity Analyses. Given that a previous pilot study of cross-sectional data showed relationships between PDI, loneliness, and depressive symptoms,[14] an indirect effects analysis was run using cross-sectional data collected at baseline to determine whether cross-sectional patterns would replicate in the present sample. More severe PDI in the past 4 weeks was associated with greater loneliness (β = 0.584; 99% CI = 0.422 to 0.718), and greater loneliness was associated with greater depressive symptoms (β = 0.328; 99% CI = 0.124 to 0.515). PDI was indirectly related to greater depressive symptoms through loneliness (standardized indirect effect = 0.191; 99% CI = 0.080 to 0.310). After accounting for loneliness, the relationship between pain during intercourse and depressive symptoms was no longer significant (standardized direct effect = 0.033; 95% CI = −0.160 to 0.231). These results suggest that — when examining using cross-sectional data — greater PDI was related to greater loneliness, which was in turn related to greater depressive symptoms.

DISCUSSION

The present study's overall objective was to examine the temporal relationships between painful sex and depressive symptoms among women and to test for loneliness as a mediator of said relationship. Results indicated that — while painful sex, loneliness, and depressive symptoms were cross-sectionally related — loneliness was not a significant mediator between painful sex at baseline and change in depressive symptoms at 6-month follow-up.

Results of the present study are consistent with some previous findings. For example, the present study replicated the results of the previously conducted pilot study[14] which found strong indirect effects of painful sex on depressive symptoms via loneliness using a cross-sectional study of college women. Various other studies have demonstrated cross-sectional correlations between painful sex and depressive symptoms.[7−14,37−43] Together, the results from the present study and previous literature suggest that painful sex, loneliness, and depressive symptoms exhibit consistent moderate-to-large positive effects when examined cross-sectionally.

Importantly, when analyses were conducted using prospective change in depressive symptoms, painful sex and loneliness were not linked to follow-up depression and loneliness was not a mediator in the present study. Several studies are available that also found little to no direct relationship between experiencing pain during sex and developing subsequent depressive symptoms.[15,16,44,45] One theme demonstrated by these studies, and perhaps a key reason why these symptoms are so strongly related cross-sectionally, but not longitudinally, in the present study might be the issue of a "third variable" or confounder. A

daily diary study[16] demonstrated that depressive symptoms were better explained by relationship satisfaction, partner responses to pain, and partner solicitations among women with vulvodynia. There are also cross-sectional studies that demonstrated no relationship between painful sex and depressive symptoms. Other studies[44,45] among found that women with vulvodynia or vulvar vestibulitis did not significantly differ from healthy controls on depressive symptoms. However, these studies were among women who were in treatment or seeking treatment, which suggests that they are a small subgroup of women with PDI.

Despite the studies that found no relationship between painful sex and depressive symptoms, several studies do demonstrate that women with pain-related sexual dysfunction are more likely to suffer from general psychological distress and increased depressive symptoms.[5,6,46,47] First, many studies were conducted in samples of women with a clinical diagnosis of dyspareunia,[6] sexual dysfunction,[5] or another diagnosis that might have a profound impact on sexual functioning, such as menopause[47] or end-stage renal disease.[46] Clinical samples increase the severity and variability of symptoms endorsed, which makes these studies better powered to detect an effect. The current study included a community-based sample with a lower range of PDI symptoms and severity, including many individuals who experienced little-to-no pain during intercourse, and most participants reported mild levels of depressive symptoms and little-to-no change in depressive symptoms on average. Second, our follow-up period of 6-months may not have been optimal. Given that depressive symptoms can exhibit trait-like characteristics (eg, high test-retest reliability on symptoms measures; increased risk of depressive episodes after experiencing the first episode),[48] it is possible that a 6-month period is insufficient for detecting variability in depressive symptom change. Recent research has also suggested that there might be several issues with measuring depressive symptoms longitudinally, including regression to the mean and response bias.[49] Third, establishing directionality of the relationship between painful sex and depressive symptoms is complex. Previous research has shown that vulvodynia is a significant risk factor for developing a subsequent mood or anxiety disorder and that a mood or anxiety disorder was a significant risk factor for developing vulvodynia.[6] Results revealed that women with vulvodynia were around 1.7 times more likely to develop a subsequent mood disorder, and women with antecedent mood disorders were 3 times more likely to develop vulvodynia.[6] In contrast, the current study was conducted in a community-based sample without clinical confirmation of disorders or symptoms. Given this complexity, it is difficult to determine the onset of painful sex vs the onset of depressive symptoms in the present analyses.

Limitations and Future Directions

Although the current study advances the science of sexual pain, loneliness, and depression using a prospective design, there were a number of limitations in the present study, which highlight the need for further investigation with methodological improvements. First, online self-report data can be influenced by social desirability, and thus, we cannot expect that each person was fully honest when completing the survey. Additionally, the present study sample (n = 148, 77% partnered, 31.14 ± 10.9 years old) are not representative of the general population. Future studies should measure each of these key variables on at least three different occasions to provide the best test of mediation effects. Further, multiyear studies may be warranted (eg, additional follow-up surveys at >6 months intervals) to account for the episodic nature of depressive symptoms. Future studies should recruit women with new pain-related sexual dysfunction diagnoses or symptoms to measure the onset or change in their depressive symptoms as a result of this diagnosis to elucidate the timeline of symptoms. Lastly, the present study used race as a covariate, which has been deemed an imprecise method of accounting for why people of different assigned races report significantly different outcomes on a variety of measures. Generally, these differences are the result of racism and racist structures — and not the result of an individual's race.[50] Future studies should explicitly measure healthcare utilization and satisfaction with care, experiences of racial, sexual, or intersectional discrimination rather than relying on race as a proxy.

CONCLUSION

The present 6-month, longitudinal study aimed to examine loneliness as a mediator of the temporal relationship between painful sex and depressive symptoms among females. Results indicated that loneliness did not mediate the relationship between PDI and depressive symptoms across this period. This study advances the literature by replicating the findings from previous work on the painful sex-loneliness-depression relationship, including a 2018 cross-sectional pilot study,[14] and expanding the findings by using longitudinal design (over 6 months) to provide a stronger test of loneliness as a mechanism in the relationship between PDI and depressive symptoms. Methodological weaknesses of the current study suggest that additional investigations are still needed to fully clarify the relationships between painful sex, loneliness, and depressive symptoms. Specific recommendations (eg, use of clinical samples, longer follow-up periods with three or more measurements of key variables, and detailed assessment of symptom onset) were provided and will be critical next steps for the field.

Corresponding Author: Misty A.W. Hawkins, MS, Oklahoma State University, 116 Psychology Building, Stillwater, OK 74078, USA. Tel.: 405-744-4593; Fax: 405-744-8067; E-mail: misty.hawkins@okstate.edu

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STATEMENT OF AUTHORSHIP

Madison E. Stout: Conceptualization; Madison E. Stout, Misty A.W. Hawkins: Methodology; Madison E. Stout: Investigation; Madison E. Stout: Writing – Original Draft; Misty A. W. Hawkins: Writing – Review & Editing; Misty A.W. Hawkins: Resources; Misty A.W. Hawkins: Supervision.

REFERENCES

1. Mitchell KR, Geary R, Graham CA, et al. Painful sex (dyspareunia) in women: Prevalence and associated factors in a British population probability survey. **BJOG: Int J Obstet Gynaecol 2017;124:1689–1697.**
2. American Psychiatric Association. Sexual and gender idenetity disorders. Diagnostic and statistical manual of mental disorders (DSM-5). 5th American Psychiatric Association; 2000 Washington DC.
3. Meana M, Maykut C, Fertel E. Painful intercourse: Genito-pelvic pain/penetration disorder. In: Hertlein KMW, G.R., Gambecia N, editors. Systemic Sex Therapy. New York, NY: Routledge; 2015.
4. Association, A.P., Sexual dysfunctions, in diagnostic and statistical manual of mental disorders. 2013: Washington, DC.
5. Boerner KE, Rosen NO. Acceptance of vulvovaginal pain in women with provoked vestibulodynia and their partners: Associations with pain, psychological, and sexual adjustment. **J Sex Med 2015;12:1450–1462.**
6. Khandker M, Brady SS, Vitonis AF, et al. The influence of depression and anxiety on risk of adult onset vulvodynia. **J Womens Health 2002;20:1445–1451 2011.**
7. Dargie E, Gilron I, Pukall CF. Provoked vestibulodynia: A comparative examination of mental health, sleep, sexual functioning, and relationship adjustment. **Clin J Pain 2017;33:870–876.**
8. De Graaff AA, Van Lankveld J, Smits LJ, et al. Dyspareunia and depressive symptoms are associated with impaired sexual functioning in women with endometriosis, whereas sexual functioning in their male partners is not affected. **Hum Reprod (Oxford, England) 2016;31:2577–2586.**
9. Iglesias-Rios L, Harlow SD, Reed BD. Depression and post-traumatic stress disorder among women with vulvodynia: Evidence from the population-based woman to woman health study. **J Womens Health (Larchmt) 2015;24:557–562.**
10. Leusink P, Kaptheijns A, Laan E, et al. Comorbidities among women with vulvovaginal complaints in family practice. **J Sex Med 2016;13:220–225.**
11. Maille DL, Bergeron S, Lambert B. Body image in women with primary and secondary provoked vestibulodynia: A controlled study. **J Sex Med 2015;12:505–515.**
12. Oliveira C, Nobre PJ. The role of trait-affect, depression, and anxiety in women with sexual dysfunction: A pilot study. **J Sex Marital Ther 2013;39:436–452.**
13. Pâquet M, Rosen NO, Steben M, et al. Daily anxiety and depressive symptoms in couples coping with vulvodynia: Associations with women's pain, women's sexual function and both partners' sexual distress. **J Pain 2018;19:552–561.**
14. Stout ME, Meints SM, Hirsh AT. Loneliness mediates the relationship between pain during intercourse and depressive symptoms among young women. **Arch Sex Behav 2018:1–10.**
15. Landry T, Bergeron S. Biopsychosocial factors associated with dyspareunia in a community sample of adolescent girls. **Arch Sex Behav 2011;40:877–889.**
16. Rosen NO, Bergeron S, Sadikaj G, et al. Relationship satisfaction moderates the associations between male partner responses and depression in women with vulvodynia: A dyadic daily experience study. **Pain 2014;155:1374–1383.**
17. Leeners B, Hengartner MP, Ajdacic-Gross V, et al. Dyspareunia in the context of psychopathology, personality traits, and coping resources: Results from a prospective longitudinal cohort study from age 30 to 50. **Arch Sex Behav 2015;44:1551–1560.**
18. Hawkley LC, Cacioppo JT. Loneliness matters: A theoretical and empirical review of consequences and mechanisms. **Ann Behav Med 2010;40:218–227.**
19. Peplau LA, Perlman D. Perspectives on loneliness. Loneliness: A sourcebook of current theory, research and therapy. John Wiley & Sons Incorporated.; 1982. p. 1–20.
20. Jaremka LM, Fagundes CP, Glaser R, et al. Loneliness predicts pain, depression, and fatigue: Understanding the role of immune dysregulation. **Psychoneuroendocrinology 2013;38:1310–1317.**
21. Vanhalst J, Klimstra TA, Luyckx K, et al. The interplay of loneliness and depressive symptoms across adolescence: Exploring the role of personality traits. **J Youth Adolesc 2012;41:776–787.**
22. Wolf LD, Davis MC. Loneliness, daily pain, and perceptions of interpersonal events in adults with fibromyalgia. **Health Psychol 2014;33:929–937.**
23. Connor JJ, Robinson B, Wieling E. Vulvar pain: A phenomenological study of couples in search of effective diagnosis and treatment. **Fam Process 2008;47:139–155.**
24. Brauer M, Lakeman M, van Lunsen R, et al. Predictors of task-persistent and fear-avoiding behaviors in women with sexual pain disorders. **J Sex Med 2014;11:3051–3063.**
25. Svedhem C, Eckert G, Wijma B. Living with genito-pelvic pain/penetration disorder in a heterosexual relationship: An interpretative phenomenological analysis of interviews with eight women. **Sex Relationship Ther 2013;28:336–349.**
26. Dolgun A, Asma S, Yıldız M, et al. Barriers to talking about sexual health issues with physicians. **Provider 2014;4:264–268.**
27. Babula O, Bongiovanni AM, Ledger WJ, et al. Immunoglobulin E antibodies to seminal fluid in women with vulvar vestibulitis syndrome: Relation to onset and timing of symptoms. **Am J Obstet Gynecol 2004;190:663–667.**
28. Junghans-Rutelonis AN, Suorsa KI, Tackett AP, et al. Self-esteem, self-focused attention, and the mediating role of fear

of negative evaluation in college students with and without asthma. **J Am Coll Health 2015;63:554–562.**

29. Rosen CBJ, Heiman S, Leiblum C. The Female Sexual Function Index (FSFI): A multidimensional self-report instrument for the assessment of female sexual function. **J Sex Marital Ther 2000;26:191–208.**
30. Kroenke K, Strine TW, Spitzer RL, et al. The PHQ-8 as a measure of current depression in the general population. **J Affect Disord 2009;114:163–173.**
31. Russell DW. UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. **J Pers Assess 1996;66:20–40.**
32. Hirsh AT, Hollingshead NA, Ashburn-Nardo L, et al. The interaction of patient race, provider bias, and clinical ambiguity on pain management decisions. **J Pain 2015;16:558–568.**
33. Hoffman KM, Trawalter S, Axt JR, et al. Racial bias in pain assessment and treatment recommendations, and false beliefs about biological differences between blacks and whites. **PNAS 2016;113:4296–4301.**
34. Meints SM, Stout M, Abplanalp S, et al. Pain-related rumination, but not magnification or helplessness, mediates race and sex differences in experimental pain. **J Pain 2017;18:332–339.**
35. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: The GAD-7. **Arch Intern Med 2006;166:1092–1097.**
36. Muthén, L.K. and B.O. Muthén, Mplus User's Guide. 1998-2011. 6th Ed.
37. Aikens JE, Reed BD, Gorenflo DW, et al. Depressive symptoms among women with vulvar dysesthesia. **Am J Obstet Gynecol 2003;189:462–466.**
38. Arnold LD, Bachmann GA, Rosen R, et al. Assessment of vulvodynia symptoms in a sample of US women: A prevalence survey with a nested case control study. **Am J Obstet Gynecol 2007;196:128. e1-6.**
39. Brown C, Bachmann G, Foster D, et al. Milnacipran in provoked vestibulodynia: Efficacy and predictors of treatment success. **J Lower Genital Tract Dis 2015;19:140–144.**
40. Desrochers G, Bergeron S, Landry T, et al. Do psychosexual factors play a role in the etiology of provoked vestibulodynia? A critical review. **J Sex Marital Ther 2008;34:198–226.**
41. Frohlich P, Meston C. Sexual functioning and self-reported depressive symptoms among college women. **J Sex Res 2002;39:321–325.**
42. Heinberg LJ, Fisher BJ, Wesselmann U, et al. Psychological factors in pelvic/urogenital pain: The influence of site of pain versus sex. **Pain 2004;108:88–94.**
43. Johannesson U, de Boussard CN, Jansen GB, et al. Evidence of diffuse noxious inhibitory controls (DNIC) elicited by cold noxious stimulation in patients with provoked vestibulodynia. **Pain 2007;130:31–39.**
44. Green J, Christmas P, Goldmeier D, et al. A review of physical and psychological factors in vulvar vestibulitis syndrome. **Int J STD AIDS 2001;12:705–709.**
45. Reed BD, Haefner HK, Punch MR, et al. Psychosocial and sexual functioning in women with vulvodynia and chronic pelvic pain. A comparative evaluation. **J Reprod Med 2000;45:624–632.**
46. Santos PR, Capote JG, Cavalcanti JU, et al. Sexual dysfunction predicts depression among women on hemodialysis. **Int Urol Nephrol 2013;45:1741–1746.**
47. Schnatz PF, Whitehurst SK, O'Sullivan DM. Sexual dysfunction, depression, and anxiety among patients of an inner-city menopause clinic. **J Womens Health 2010;19:1843–1849.**
48. Penninx BW, Nolen W A, Lamers F, et al. **Two-year course of depressive and anxiety disorders: results from the Netherlands Study of Depression and Anxiety (NESDA) 2011;133:76–85.**
49. Fried EI, van Borkulo CD, Epskamp S, et al. Measuring depression over time… Or not? Lack of unidimensionality and longitudinal measurement invariance in four common rating scales of depression. **Psychol Assess 2016;28:1354.**
50. Sewell AA. The racism-race reification process: A mesolevel political economic framework for understanding racial health disparities. **Soc Race Eth 2016;2:402–432.**