

Provoked Vestibulodynia: Mediators of the Associations Between Partner Responses, Pain, and Sexual Satisfaction

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Abstract Provoked vestibulodynia (PVD) is a chronic, recurrent vulvo-vaginal pain condition affecting 12% of the general population, and is associated with sexual dysfunction, psychological distress, and reduced quality of life. There is growing interest in the role of interpersonal variables in PVD, which have been widely neglected. In a sample of 175 couples, the present study examined the mediating roles of partner and participant catastrophizing and self-efficacy in the association between solicitous partner responses and pain intensity, and that of dyadic adjustment in the association between solicitous and negative partner responses and sexual satisfaction. Couples completed measures of partner responses, catastrophizing, self-efficacy, dyadic adjustment, and depression. Women also completed measures of pain, sexual satisfaction, and sexual function. Controlling for depression and solicitousness perceived by the other member of the couple, catastrophizing and self-efficacy partially mediated the association between higher solicitous responses and higher pain during intercourse, accounting for 26 and 25% of the variance in this association for participant and partner-perceived responses, respectively. For both participant and partners, only pain catastrophizing was a unique mediator. Controlling for depression, sexual function and partner-perceived responses, dyadic adjustment partially

mediated the association between higher participant-perceived solicitous responses and higher sexual satisfaction, and between higher participant-perceived negative responses and lower sexual satisfaction, accounting for 26% of the variance in each association. The current findings suggest that catastrophizing and dyadic adjustment may constitute a route by which partner responses exacerbate pain and increase or decrease sexual satisfaction in PVD couples.

Keywords Provoked vestibulodynia · Pain · Sexual satisfaction · Partner responses · Catastrophizing · Dyadic adjustment

Introduction

Vulvodynia is characterized by vulvar discomfort or a burning pain, for which there are no relevant physical findings or specific clinically identifiable neurologic disorder. The International Society for the Study of Vulvovaginal Disease (ISSVD) classifies vulvodynia into two symptom presentations: localized, which involves a portion of the vulva, and generalized, which involves the entire vulva. The most common subtype of localized vulvodynia is provoked vestibulodynia (PVD), formerly vulvar vestibulitis syndrome. With a prevalence of 12% in the general population (Harlow, Wise, & Stewart, 2001), PVD is a chronic, recurrent vulvo-vaginal pain condition, characterized by moderate to severe pain specific to the vestibule and which is elicited via pressure, in both sexual and non-sexual contexts (Moyal-Barracco & Lynch, 2004).

Having PVD is associated with negative outcomes, including lower sexual desire, arousal, satisfaction, frequency of orgasm, and intercourse as well as heightened anxiety, depression, fear of pain, hypervigilance, and catastrophizing compared to women without PVD (Gates & Galask, 2001; Hallam-Jones, Wylie,

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Osborne-Cribb, Harrington, & Walters, 2001; Lundvist & Bergdahl, 2003; Meana, Binik, Khalifé, & Cohen, 1997; Payne, Binik, Amsel, & Khalifé, 2005; Payne et al., 2007). There appear to be no significant differences in self-reported dyadic adjustment compared to women without PVD (Hallam-Jones et al., 2001; Meana et al., 1997; Reissing, Binik, Khalifé, Cohen, & Amsel, 2003). A number of risk factors for PVD have been identified (for a summary, see van Lankveld et al., 2010). Still, there is much that remains unknown about the etiology of this multifactorial condition, particularly its psychosocial dimensions. Psychosocial factors, such as depression and maladaptive coping styles (e.g., avoidance, passivity) among others, are known to increase the risk for developing persistent pain conditions (Gatchel & Turk, 1999), and dyadic variables in particular have been the focus of research in other pain populations. The interpersonal context is particularly relevant given that the partners both elicit and witness the pain in women with PVD. Partners may also suffer negative sexual and relational consequences, including lower intercourse frequency and sexual satisfaction, and poorer dyadic adjustment (Desrosiers et al., 2008; Jodoin et al., 2008).

Recent calls in the literature have advocated for more research on how interpersonal variables may affect women's pain experience and the sexual experiences of both members of the couple (McCabe et al., 2010). Further, pain and sexual impairment may be distinct and partially independent phenomena, as evidenced by the lack of significant correlation between pain intensity during intercourse and overall sexual function, as well as pain and sexual satisfaction, in a recent study of women with PVD (Rosen, Bergeron, Leclerc, Lambert, & Steben, 2010). Thus, interpersonal variables may show differing patterns of association with these two possibly unrelated yet critical outcomes.

Evidence from the chronic pain literature (e.g., Cano, Johansen, Leonard, & Hanawalt, 2005; Romano et al., 1995) and, more recently, the PVD area (Desrosiers et al., 2008; Rosen et al., 2010) demonstrates that partners may reinforce and perpetuate a persons' pain experience. Two types of partner responses to patient's pain that have been documented include: (1) solicitous responses, which are partner reactions of sympathy, attention, and support and (2) negative responses, which refer to partner reactions that include critical remarks or demonstrations of hostility or avoidance. Although other types of partner responses such as facilitative responses—which consist of encouraging responses to a person's efforts at adaptive coping with pain—may decrease pain and disability, (Pence, Thorn, Jensen, & Romano, 2008; Schwartz, Jensen, & Romano, 2005), prior research has emphasized the detrimental impact of solicitous and negative responses. Specifically, greater partner solicitous and negative responses are associated with greater pain, disability, and psychosocial problems (Boothby, Thorn, Overduin, & Ward, 2004; Cano, Gillis, Heinz, Geisser, & Foran, 2004; Kerns, Haythornthwaite, Southwick, & Giller, 1990; Waltz, Kriegel, & van't Pad Bosh, 1998). Partner responses may reinforce a person's avoidance of painful activities, encourage pas-

sivity, and increase the likelihood that they will behave similarly in the future (Flor et al., 1995; Romano et al., 1995).

Expressions of pain to significant others may also serve an important social purpose (Leonard, Cano, & Johansen, 2006). According to the communal coping model (CCM), pain catastrophizing, defined as a negative cognitive appraisal, may serve to evoke empathic responses, assistance or to maximize proximity. Moreover, responses from others may trigger, maintain or reinforce catastrophizing in the person experiencing pain (Sullivan et al., 2001). Researchers have shown that daily fluctuations in the perceived level of support from one's partner influenced participant catastrophizing (Holtzman & DeLongis, 2007). Partner responses may cue the person with pain to attend more to their pain as well as support their exaggerated view of the pain, subsequently contributing to a heightened pain experience (Craig & Prkachin, 1978; Keefe, Lefebvre, & Smith, 1999).

The CCM may be a useful framework for examining the contribution of interpersonal factors in PVD. Partner responses may heighten pain catastrophizing, which, in turn, could contribute to increased pain or function to maintain intimacy in spite of the pain. The CCM has stimulated research on the interrelations among catastrophizing, partner responses, pain, disability, and depression (Boothby et al., 2004; Buenaver, Edwards, & Haythornthwaite, 2007; Giardino, Jensen, Turner, Ehde, & Cardenas, 2003). One study showed that the positive association between participant catastrophizing and pain was stronger for those who perceived greater partner solicitousness (Giardino et al., 2003). No studies to date have examined partner or participant catastrophizing as a mediator of the association between solicitous responses and pain. Exploring mediating variables is an important step because it suggests a pathway through which partner responses may impact pain and psychosocial outcomes (Cano, Weisberg, & Gallagher, 2000). Prior research has established an empirical basis for investigating this hypothesis, demonstrating core associations between greater solicitous responses and heightened pain, greater solicitous responses and greater catastrophizing, and greater catastrophizing and heightened pain (Boothby et al., 2004; Buenaver et al., 2007; Cano, 2004; Giardino et al., 2003; Sullivan et al., 2001).

Another cognitive variable, pain self-efficacy—beliefs about one's ability to cope and control pain—has emerged as an important predictor of both pain and disability in chronic pain populations (Ayre & Tyson, 2001; Lefebvre et al., 1999; Porter, Keefe, Garst, McBride, & Baucom, 2008; Porter et al., 2002; Woby, Urmston, & Watson, 2007). Studies have demonstrated associations between participant- and partner-perceived self-efficacy and participant pain as well as the psychosocial functioning of both members of the dyad (Porter et al., 2002, 2008). These results underscore the potential for partner-related cognitive variables to influence outcomes in people with pain.

Recent studies have shown that both catastrophizing and pain self-efficacy contributed unique variance to predicting intercourse pain in women with PVD both cross-sectionally and

prospectively (Desrochers, Bergeron, Khalifé, Dupuis, & Jodoin, 2009; Desrochers, Bergeron, Khalifé, Dupuis, & Jodoin, 2010). Further, higher participant- and partner-perceived solicitous responses, that is, partner responses that were assessed from both the women's and partners' perspectives, were associated with higher women's vulvo-vaginal pain intensity (Desrosiers et al., 2008; Rosen et al., 2010). It seems plausible that self-efficacy may act as an additional mediating variable between partner solicitousness and participant's pain given the established associations of prior research described above. In sum, partner solicitousness may encourage avoidance of sexual intercourse and/or exacerbate vulvo-vaginal pain by increasing catastrophizing and decreasing self-efficacy.

Prior PVD studies found no significant relationship between partner responses and women's global sexual functioning (Desrosiers et al., 2008; Rosen et al., 2010). Participant-perceived higher solicitous and lower negative partner responses were, however, associated with greater sexual satisfaction (Rosen et al., 2010). Lawrance and Byers (1995) described sexual satisfaction as "an affective response arising from one's subjective evaluation of the positive and negative dimensions associated with one's sexual relationship." Although positively correlated, sexual satisfaction may be distinguished, in part, from sexual functioning because it emphasizes the interpersonal aspect of sexual activities, whereas sexual functioning focuses on the intrapersonal aspects of the sexual response (Rosen et al., 2000). Although studies have shown significant improvements in sexual function across treatment groups for women with PVD, prior research has evidenced little success in terms of improving sexual functioning above clinical thresholds, regardless of the type of intervention (Bergeron, Binik, Khalifé, Pagidas, & Glazer, 2001; Bergeron, Khalifé, Glazer, & Binik, 2008; Masheb, Kerns, Lozano, Minkin, & Richman, 2009). Consequently, changes in the more subjective measures of sexual distress and satisfaction are emerging as important outcome variables and key targets for intervention.

Sexual satisfaction is lower in women with dyspareunia compared to control women (Danielsson, Sloberg, & Wilman, 2000; Wouda et al., 1998). In terms of partner responses, higher solicitousness could be interpreted by women as greater partner sensitivity to their pain, resulting in higher sexual satisfaction. Higher negative partner responses may signal a lack of sensitivity and create a negative interpersonal context for sexual activity (Desrosiers et al., 2008; Rosen et al., 2010), thereby decreasing sexual satisfaction. Prior research has laid the empirical foundation for examining the hypothesis that dyadic adjustment mediates the association between partner responses and sexual satisfaction. Participant-perceived (but not partner-perceived) higher solicitous and lower negative partner responses were associated with greater sexual satisfaction among women with PVD (Rosen et al., 2010). Further, lower solicitous and higher negative partner responses were associated with lower dyadic adjustment in chronic pain participants (Cano et al., 2000,

2004; Pence et al., 2008) and in women with PVD (Rosen et al., 2010). Finally, among women reporting no sexual problems, higher dyadic adjustment was associated with higher sexual satisfaction (Lawrance & Byers, 1995).

In the present study, predictor and mediating variables were assessed from the perspective of the participant (i.e., women) and the partners, whereas the majority of prior research in chronic pain and sexuality has sampled the participant only. We expected that (1) catastrophizing and self-efficacy would independently mediate the association between partner solicitousness and pain intensity in women with PVD for both participant and partner-perceived variables, and (2) dyadic adjustment would mediate the associations between partner solicitous and negative responses and women's sexual satisfaction for variables assessed from the participant's perspective only.

Method

Participants

Women were recruited at regularly scheduled clinical appointments to the study co-investigator gynecologists or other health professionals (e.g., psychologists). The health care professional informed potential participants of the study and then a research assistant explained the details and obtained consent. Further, potential participants were told that their participation was voluntary and declining to participate would in no way affect their care by the gynecologist. Participants were also recruited through advertisements in newspapers and Internet websites in a large metropolitan area. The sample of participants included 41% recruited at visits to physicians, 7% recruited at visits to other health professionals (e.g., psychologist, physiotherapist), 44% recruited through advertisements, 7% recruited via participation in another PVD study, and 1% unknown.

Participants were screened for eligibility, using a structured interview. Screening either occurred in-person at the gynecologist's office, in which case a gynecologic examination confirming the diagnosis was performed, or by telephone if recruited through advertisements, and in this case the diagnosis was self-reported. Eligible participants were asked whether their partners would be interested. In order to ensure a homogenous sample of participants with PVD, the inclusion criteria for the women included: (1) pain during intercourse which was subjectively distressing, occurs(ed) on 75% of intercourse attempts, and has lasted for at least 6 months, (2) pain located in the vulvo-vaginal area (i.e. at the entrance of the vagina), (3) pain limited to intercourse and other activities involving pressure to the vestibule (e.g., bicycle), and (4) cohabitating with a partner for at least 6 months.

Exclusion criteria were: (1) vulvar pain not clearly linked to intercourse or pressure applied to the vestibule, (2) presence of one of the following: active infection previously diagnosed by a

physician, vaginismus (a self-report of the vagina being physically closed making it impossible for penetration), pregnancy and, age less than 18 or greater than 45 years. There were no additional inclusion criteria for partners. The only exclusion criterion for partners was age less than 18 years. Of the 218 heterosexual couples who met eligibility criteria and agreed to participate, 13 partners did not return their questionnaires, 10 couples had missing data representing more than 10% of a measure, and 20 women reported no sexual activity in the preceding four weeks, resulting in a final sample size of 175 (81%) couples.

Measures

Partner Responses to Pain

Participant's perceived *partner responses* were measured with the Significant Other Response Scale, a subscale of the West Haven-Yale Multidimensional Pain Inventory (MPI) (Kerns, Turk, & Rudy, 1985). This scale assesses the participant's perceived partner responses to pain, including negative (four items, e.g., "expresses frustration at me") and solicitous (six items, e.g., "suggests we stop engaging in current sexual activity") responses. Items were previously adapted to the current population of women with PVD (Rosen et al., 2010). The questionnaire's reliability and validity have been well established (Kerns & Jacob, 1992; Kerns et al., 1985). Partners completed the validated partner version of this scale (Sharp & Nicholas, 2000). Participants indicated the frequency of partner responses to the woman's pain during or after intercourse, on a scale ranging from 1 (*never*) to 7 (*very frequently*). Higher scores indicate greater frequency of partner responses. In line with the prior adaptation for a PVD population (Rosen et al., 2010), two items from the participant and partner solicitous subscales were deleted to improve the internal consistency of the scales. Although amenable to adaptation, these items were not representative of the typical solicitous behaviors of partners from a clinical standpoint (e.g., "suggests we turn on the TV") and, from a statistical standpoint, they did not load onto the solicitous subscale. Scores could thus range from 4 to 28 on each subscale. In the present sample, Cronbach's alphas were .76 and .69 for the solicitous subscales and .83 and .72 for the negative subscales, for the participant and partner respectively.

Proposed Mediators

Pain catastrophizing was assessed with the Pain Catastrophizing Scale (PCS) (Sullivan, Bishop, & Pivik, 1995). This scale consists of 13 items measuring exaggerated negative thoughts and feelings about the meaning of pain. Items were scored on a 5-point scale from 0 (*not at all*) to 4 (*all the time*). The PCS is composed of three subscales: rumination (e.g., "I keep thinking about how much it hurts"), magnification (e.g., "I wonder

whether something serious may happen"), and helplessness (e.g., "There is nothing I can do to reduce the intensity of the pain"). Higher scores indicate greater catastrophizing and scores can range from 0 to 52. The reliability and validity of the PCS have been well established (Osman et al., 2000; Sullivan et al., 1995). Partners completed the validated partner version of this scale with reference to their thoughts and feelings when their significant other experiences pain (Cano, Leonard, & Franz, 2005).

Pain self-efficacy was assessed with the Painful Intercourse Self-Efficacy Scale (PISES; (Desrochers et al., 2009), which was adapted from the Arthritis Self-Efficacy Scale (Lorig, Chastain, Ung, Shoor, & Holman, 1989). It consists of 20 items with three subscales measuring three dimensions of self-efficacy: self-efficacy for controlling pain during intercourse (e.g., "How certain are you that you can decrease your pain quite a bit?"), self-efficacy for sexual function (e.g., "How certain are you that you can attempt intercourse and achieve partial penetration?"), and self-efficacy for controlling other symptoms (e.g., "How certain are you that you can control your sexual desire and arousal?"). Participants indicated their perceived ability to carry out sexual activity or to achieve particular outcomes in pain management by responding on a scale ranging from 10 (*very uncertain*) to 100 (*very certain*). Higher scores indicate greater self-efficacy and total scores range from 200 to 2000. The reliability and validity of the original version has been established (Lorig et al., 1989) and the factor structure of the adapted version has been shown to be identical to the original scale (Desrochers et al., 2009). Partners completed an adapted version with reference to their beliefs about the participant's self-efficacy in the same situations. Prior research has successfully adapted a partner version of participant's pain self-efficacy (e.g., Porter et al., 2002). In the current sample, Cronbach's alpha of the subscales ranged from .79 to .89 for women and .74 to .91 for partners, which is consistent with prior research (Desrochers et al., 2009).

Dyadic adjustment was assessed with the Revised Dyadic Adjustment Scale (R-DAS) (Busby, Christensen, Crane, & Larson, 1995). Participants indicated their responses to 14 items on a scale ranging from 0 (*always disagree/all of the time*) to 5 (*always agree/never*). Higher scores indicate better adjustment and total scores can range from 0 to 70. This scale includes three subscales: consensus (e.g., "Making major decisions"), satisfaction (e.g., "How often do you and your partner quarrel?"), and cohesion (e.g., "Do you and your partner engage in outside interests together?"). This questionnaire has been shown to have excellent reliability and validity (Busby et al., 1995).

Covariates

Women's *sexual functioning* was measured with the Female Sexual Function Index (FSFI) (Rosen et al., 2000). Prior research has established a positive association between sexual function and sexual satisfaction, although the two constructs can also be distinguished (Lawrance & Byers, 1995). We included sexual

function as a covariate when sexual satisfaction was the outcome variable in order to assess the unique contribution of the variables proposed in our mediation model. The FSFI consists of 19 items assessing five dimensions of global sexual functioning including desire, arousal, lubrication, orgasm, satisfaction, and pain/discomfort. The sexual satisfaction subscale was removed from the total score to avoid overlap with our outcome measure of sexual satisfaction. The FSFI has demonstrated excellent psychometric properties (Daker-White, 2002). Some items were reverse scored so that lower scores indicate greater dysfunction across all items and for the total score. Total scores in this sample ranged from 2 to 26.

Depressive symptoms were assessed with the Beck Depression Inventory-II (BDI-II; (Beck, Steer, & Brown, 1996), which has shown good reliability and validity previously, and in chronic pain populations (e.g., Turner & Romano, 1984). Prior chronic pain research has established strong associations among pain intensity, disability, partner responses, and depression (Cano et al., 2000, 2004; Kerns et al., 1990). We therefore included depression as a covariate in our analyses in order to assess the unique contribution of partner responses to pain. The BDI-II consists of 21 items with single item scores ranging from 0 (low intensity) to 3 (high intensity). Higher scores indicate more depressive symptoms and total scores can range from 0 to 63.

Dependent Variables

Women reported their *pain intensity* by indicating the average level of pain during intercourse (in the last 6 months) using a horizontal analog scale ranging from 0 (*no pain*) to 10 (*worst pain ever*). This measure has been shown to detect significant treatment effects in PVD women (Bergeron et al., 2001) and positively correlates with other pain intensity measures (Desrochers et al., 2009).

Women's *sexual satisfaction* was assessed with the Global Measure of Sexual Satisfaction scale, which has good psychometric properties (Lawrance & Byers, 1995). This scale consists of five items to which participants respond on a 7-point Likert scale. Higher scores indicate greater satisfaction and total scores can range from 5 to 35.

Procedure

Participants and their partners were provided with separate packages containing consent forms, a sociodemographic questionnaire, standardized questionnaires, and preaddressed and pre-stamped envelopes for returning the materials. Participants and their partners completed measures of partner responses, catastrophizing, self-efficacy, dyadic adjustment, and depression, while only the participants completed measures of pain, sexual function, and sexual satisfaction. Couples were contacted every 2 weeks after receiving the questionnaires, up to a maximum of six telephone follow-ups, as a reminder to return their

questionnaires. As compensation, after receiving the questionnaires from both partners, the couple was scheduled for a 30-min telephone psychological consultation focusing on PVD, with 71% of participants accepting this compensation. Those who were not interested in a telephone consultation received the same information in written form. We do not believe that the proposed compensation biased our sample in any way. The present study was approved by our university and university health center's institutional review boards.

Data Analyses

Pearson product-moment correlations were conducted to examine the bivariate relationships between all study variables and to confirm that the theoretically proposed covariates were significantly related to the dependent variables at $p < .05$. Mediation was tested separately for each independent and dependent variable and separately for participants and partners. The overall relationship between the independent variable and the dependent variable does not have to be significant in order to test for mediation (Collins, Graham, & Flaherty, 1998; Kenny, Kashy, & Bolger, 1998; MacKinnon, Krull, & Lockwood, 2000; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002). In these cases, mediation may be pursued because of prior theoretically or empirically-driven hypotheses which suggest that the relationship between the independent and dependent variable only exists through the mediator (Collins et al., 1998). It is also possible that the direct and mediated effects of an independent variable on a dependent variable have opposite signs, in which case their effects may cancel each other out, resulting in a non-significant overall relationship (MacKinnon et al., 2000).

To assess the indirect effect of participant- and partner-perceived solicitous responses on pain intensity through the proposed cognitive factors and while controlling for significant covariates, a multiple mediation model was tested in lieu of separate simple mediation models. Given that the subscales of the self-efficacy measure assess self-efficacy for distinct domains (pain, sexual function, and other symptoms), each subscale was assessed as a separate mediator along with the total score for pain catastrophizing. A simple mediation model was used to assess the indirect effect of participant-perceived solicitous and negative responses on sexual satisfaction through the single mediator, dyadic adjustment, controlling for significant covariates.

Preacher and Hayes (2004, 2008) have advocated the use of bootstrapping—a nonparametric resampling procedure that does not assume normality of the sampling distribution—as the superior method for testing mediation because it demonstrates greater power while maintaining good control over the possibility of a Type 1 error. Traditional tests of indirect effects (e.g., Sobel's test) use the standard normal distribution to generate p values and tend to be overly conservative (MacKinnon et al., 2002). The current study ran bootstrapping procedures with 5,000 samples (as suggested by Preacher & Hayes, 2004) to

construct bias corrected and accelerated (BCa) confidence intervals around the regression coefficients in the mediation analysis and to test the significance of the indirect effects (Preacher & Hayes, 2008). The difference between the total and direct effects is the total indirect effect through the mediators. A confidence interval that does not include zero is considered significantly different from zero.

Results

Sample Characteristics

Table 1 shows the descriptive statistics for the sociodemographics, independent, and dependent variables in this sample. All participants were in heterosexual relationships. Women whose partner did not return the questionnaires did not differ from study participants on any of the study variables nor did they differ on any sociodemographic variables.

Zero-Order Correlations

Table 2 shows the inter-correlations among the independent, dependent, and mediator variables. As expected, partner-perceived solicitousness was positively correlated with pain intensity in women with PVD. Inconsistent with prior research, participant-perceived solicitousness was not significantly correlated with pain intensity in women with PVD. However, as noted, a significant correlation is not a necessary condition for examining mediation hypotheses. Participant-perceived solicitousness positively correlated with participant catastrophizing, and partner-perceived solicitousness positively correlated with partner catastrophizing. From the perspective of both participants and partners, catastrophizing was positively correlated, and the self-efficacy subscales were negatively correlated, with pain intensity in women with PVD. Participant-perceived solicitous responses were positively correlated with women's sexual satisfaction and with dyadic adjustment. Participant-perceived negative responses were negatively correlated with women's sexual satisfaction and dyadic adjustment. Dyadic adjustment was positively correlated with women's sexual satisfaction. In terms of the covariates, as expected, pain intensity in women with PVD was positively correlated with depressive symptoms ($r = .19, p < .05$), and women's sexual satisfaction was positively correlated with sexual function ($r = .42, p < .01$).

Mediation of Solicitous Partner Responses and Pain Intensity by Catastrophizing and Self-Efficacy

As shown in Fig. 1a and b, catastrophizing and the pain, function, and other symptoms subscales of self-efficacy partially mediated the effects of participant- and partner-perceived solicitousness

Table 1 Descriptive statistics of sample ($N = 175$)

	<i>M</i> (range) or <i>N</i>	<i>SD</i> or %
Variables		
Age (years)		
Participants	32.18 (18–45)	11.31
Partners	34.75 (18–68)	11.73
Women's duration of pain (months)	74.00 (6–526)	80.00
Education level (years)		
Participants	16.04 (7–26)	2.84
Partners	15.54 (8–24)	3.21
Marital status		
Cohabiting	132	75.4
Couple's annual income ($N = 171$)		
\$0–19,999	16	9.5
\$20,000–39,000	21	13.1
\$40,000–59,000	41	24.4
\$60,000	93	53
Religion		
Participants ($N = 169$)		
Catholic	151	86.3
Other	8	5.8
No religion	8	4.6
Partners ($N = 147$)		
Catholic	125	71.4
Other	13	7.5
No religion	8	4.6
Culture		
Participants		
French–Canadian	157	89.7
English–Canadian	5	2.9
Other	13	7.4
Partner ($N = 157$)		
French–Canadian	129	73.4
English–Canadian	12	6.9
Other	16	10.8
Independent variables		
Solicitous (MPI)		
Participants	16.54 (4–24)	3.53
Partners	18.05 (6–24)	2.72
Negative (MPI)		
Participants	6.20 (4–24)	9.68
Partners	5.75 (4–17)	6.65
Depression (BDI)		
Participants	13.51 (0–45)	9.68
Partners	7.22 (0–34)	6.65
Dyadic adjustment (R-DAS)		
Participants	51.30 (28–66)	7.00
Partners	51.30 (29–67)	6.73
Sexual function (FSFI)	15.71 (2–26)	4.93

Table 1 continued

	<i>M</i> (range) or <i>N</i>	<i>SD</i> or %
Mediators		
Catastrophizing (PCS)		
Participants	28.67 (2–52)	10.35
Partners	28.03 (5–51)	9.32
Self-efficacy (PISES; pain)		
Participants	261.17 (50–480)	95.90
Partners	263.87 (50–740)	105.54
Self-efficacy (PISES; function)		
Participants	651.01 (90–900)	186.66
Partners	596.62 (90–900)	207.76
Self-efficacy (PISES; other)		
Participants	321.42 (60–550)	99.7
Partners	317.48 (60–570)	100.87
Dependent variables (participants)		
Pain intensity	7.20 (3–10)	1.61
Sexual satisfaction (GMSEX)	23.01 (5–35)	6.12

Pain pain intensity on scale of 0–10, *FSFI* Female Sexual Function Index, *GMSEX* Global Measure of Sexual Satisfaction, *BDI-II* Beck Depression Inventory-II, *MPI* Multidimensional Pain Inventory, *R-DAS* Revised-Dyadic Adjustment Scale, *PCS* Pain Catastrophizing Scale, *PISES* Painful Intercourse Self-Efficacy Scale

on pain intensity in women with PVD. The total and direct effects of participant-perceived solicitousness on pain intensity in women with PVD were .01, *ns*, and $-.02$, *ns*, respectively, and .09, $p < .01$ and .07, $p < .05$ for partner-perceived solicitousness on pain intensity.

For participant-perceived solicitousness, controlling for depression and partner-perceived solicitousness, the total indirect effect was significant, with a point estimate of .03 and a 95% biased corrected and accelerated (BCa) bootstrap confidence interval of .00 to .06. Although the association between participant-perceived solicitousness and pain intensity before and after controlling for the mediators was not significant, the drop in the coefficient of the direct path was significant. This pattern is indicative of partial mediation, and is of primary relevance when testing mediation. An examination of the specific indirect effects indicated that only participant catastrophizing was a significant mediator with a 95% BCa confidence interval of .00 to .04. Thus, the indirect effects of the participant self-efficacy variables did not contribute to the indirect effect above and beyond the effect of catastrophizing. From Fig. 1a, the directions of the path coefficients were consistent with the interpretation that higher participant-perceived solicitousness led to higher participant catastrophizing, which, in turn, led to greater pain intensity. The pattern of coefficients indicated inconsistent mediation because the direct and mediated effects of the independent variable on the dependent variable had opposite signs. Statistical procedures for testing the significance of inconsistent mediation are the same as for mediation effects (MacKinnon et al., 2000). In the mediation

analysis, the direct association between solicitous responses and pain was negative but not significant. However, the mediational path, which was significant, showed the opposite (positive) effect: greater solicitous responses were associated with higher catastrophizing, which was associated with more pain. It is important to note that only the partial mediation effect was a significant pathway, suggesting that this effect was stronger than the non-significant direct effect of solicitousness on pain. The percentage of the total effect that was accounted for by the mediators is a useful estimate of the relative strength of the mediation effect (MacKinnon & Dwyer, 1993). Controlling for depression and partner-perceived solicitousness, 26% of the total effect of participant-perceived solicitousness on pain intensity was partially mediated by participant catastrophizing and self-efficacy.

For partner-perceived solicitousness, controlling for depression and participant-perceived solicitousness, the total indirect effect was significant, with a point estimate of .02 and a 95% BCa bootstrap confidence interval of .01 to .07. The association between partner-perceived solicitousness and pain intensity before and after controlling for the mediators remained significant, indicating partial mediation, and the drop in the coefficient of the direct path was significant. An examination of the specific indirect effects indicated that only partner catastrophizing was a significant mediator with a 95% BCa confidence interval of .01 to .05. Thus, the indirect effects of the partner-perceived self-efficacy variables again did not contribute to the indirect effect above and beyond the effect of catastrophizing. From Fig. 1b, the directions of the path coefficients were consistent with the interpretation that higher partner-perceived solicitousness led to higher partner catastrophizing, which, in turn, led to greater pain intensity. Controlling for depression and participant-perceived solicitousness, 25% of the total effect of partner-perceived solicitousness on pain intensity in women with PVD was partially mediated by partner catastrophizing and self-efficacy.

Mediation of Partner Responses and Sexual Satisfaction by Dyadic Adjustment

As shown in Fig. 2a and b, dyadic adjustment partially mediated the effects of solicitous and negative responses on women's sexual satisfaction from the participant's perspective only. The total and direct effects of participant-perceived solicitousness on sexual satisfaction were .30, $p < .001$, and .23, $p < .01$, respectively, and $-.37$, $p < .01$ and $-.27$, $p < .05$ for negative responses on women's sexual satisfaction. Controlling for participant's sexual function, depression, as well as partner-perceived solicitousness, the total indirect effect of dyadic adjustment on the association between solicitousness and sexual satisfaction was significant, with a point estimate of .07 and a 95% BCa bootstrap confidence interval of .02 to .16. Controlling for sexual function, depression, and partner-perceived negative responses, the total indirect effect of dyadic adjustment on the

Table 2 Correlations between partner responses, women’s pain intensity, and mediator variables (N = 175)

	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Pain intensity-W	-.12	.10	.26**	.05	.10	-.09	.39**	.32**	-.30**	-.13	-.38**	-.28**	-.24**	-.21*
2. Sexual satisfaction-W	-	.26**	.01	-.31**	-.21*	.32**	-.19**	-.21*	.26**	.15*	.24**	.20*	.28**	.15*
3. Solicitous-W	-	-	.41**	-.39**	-.26**	.38**	.19*	-.04	.01	.04	-.12	-.06	.02	-.10
4. Solicitous-P	-	-	-	-.10	-.15*	.15*	.14	.23**	.06	.02	-.08	-.15*	-.04	-.01
5. Negative-W	-	-	-	-	.54**	-.44**	.01	.24**	-.05	-.16*	-.19*	-.32**	-.06	-.15*
6. Negative-P	-	-	-	-	-	-.29**	.08	.27**	-.02	-.07	-.17*	-.18*	-.09	-.21*
7. Dyadic adjustment-W	-	-	-	-	-	-	.03	-.23**	.25*	.22*	.14	.20*	.18*	.14
8. Catastrophizing-W	-	-	-	-	-	-	-	.20*	-.38**	-.13	-.32**	-.19*	-.41**	-.31**
9. Catastrophizing-P	-	-	-	-	-	-	-	-	-.09	-.19*	-.14	-.32**	-.07	-.18*
10. Self-efficacy-W (pain)	-	-	-	-	-	-	-	-	-	.26**	.37**	.14	.58**	.26**
11. Self-efficacy-P (pain)	-	-	-	-	-	-	-	-	-	-	.20*	.27**	.21*	.44**
12. Self-efficacy-W (function)	-	-	-	-	-	-	-	-	-	-	-	.64**	.42**	.39**
13. Self-efficacy-P (function)	-	-	-	-	-	-	-	-	-	-	-	-	.21*	.48**
14. Self-efficacy-W (other)	-	-	-	-	-	-	-	-	-	-	-	-	-	.34**
15. Self-efficacy-P (other)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

W woman, P partner, pain intensity pain intensity on scale of 0–10, sexual satisfaction Global Measure of Sexual Satisfaction, solicitous Multidimensional Pain Inventory-solicitous subscale, negative Multidimensional Pain Inventory-negative subscale, dyadic adjustment Revised Dyadic Adjustment Scale, catastrophizing Pain Catastrophizing Scale, self-efficacy Painful Intercourse Self-Efficacy Scale (pain subscale; function subscale; other subscale)

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

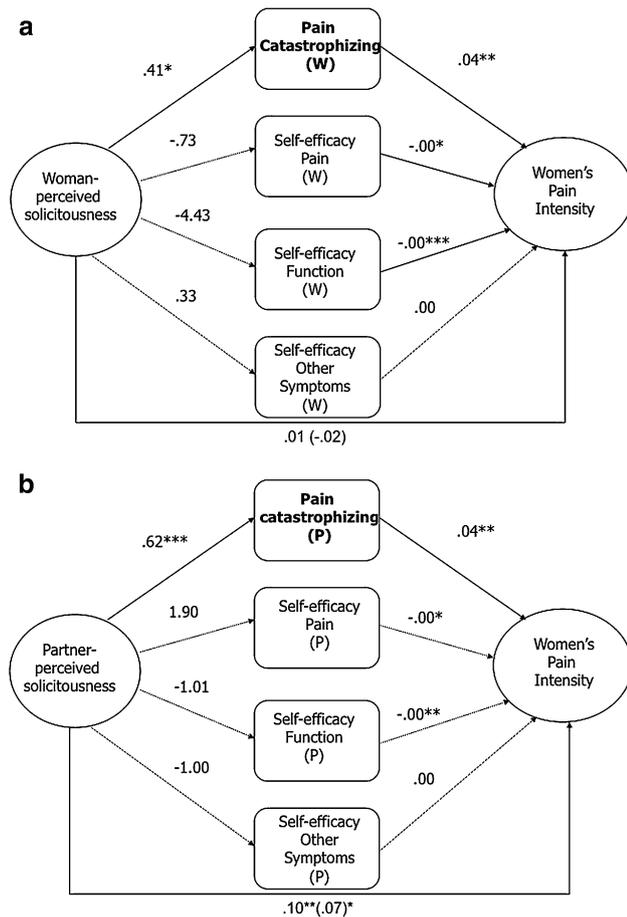


Fig. 1 Path coefficients (standardized regression weights) for the mediational model of the relation between participant-perceived (a) and partner-perceived (b) solicitousness and pain intensity. Value outside the parentheses represents the total effect of solicitousness on pain prior to including the mediators; value inside the parentheses represents the direct effect, from bootstrapping analyses, after the mediators were included. Dashed lines indicate non-significant paths. *** $p < .001$; ** $p < .01$; * $p < .05$. W participant-perceived; P partner-perceived

association between negative responses and sexual satisfaction was significant, with a point estimate of $-.10$ and a 95% BCa bootstrap confidence interval of $-.25$ to $-.02$. The association between solicitousness and sexual satisfaction, before and after controlling for the mediator remained significant, indicating partial mediation. However, the association between negative partner responses and sexual satisfaction after controlling for the mediator was no longer significant, indicating full mediation. The drop in the coefficient of the direct paths was also significant. From Fig. 2a, the directions of the path coefficients were consistent with the interpretation that higher participant-perceived solicitousness led to higher participant-perceived dyadic adjustment, which, in turn, led to more sexual satisfaction. From Fig. 2b, higher participant-perceived negative responses led to lower participant-perceived dyadic adjustment, which, in turn, led to less sexual satisfaction.

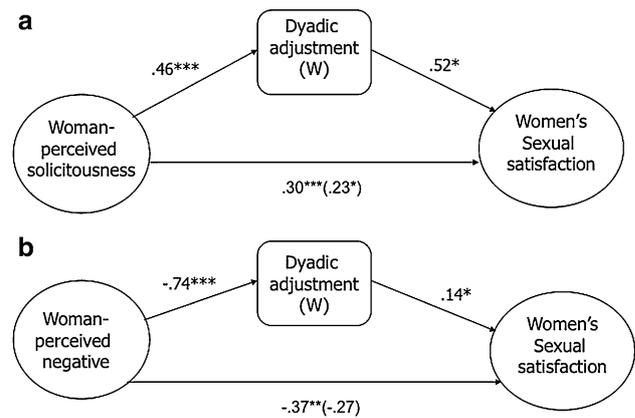


Fig. 2 Path coefficients (standardized regression weights) for the mediational model of the relation between participant-perceived solicitous (a) and negative (b) responses and sexual satisfaction. Value outside the parentheses represents the total effect of the partner response on sexual satisfaction prior to including the mediator; value inside the parentheses represents the direct effect, from bootstrapping analyses, after the mediator was included. *** $p < .001$; ** $p < .01$; * $p < .05$; † $p < .10$. W participant-perceived

Controlling for the relevant covariates, 26% of the total effect of participant-perceived solicitousness on women's sexual satisfaction, and 26% of the total effect of participant-perceived negative responses on women's sexual satisfaction, was partially or fully mediated by participant-perceived dyadic adjustment.

Discussion

The objective of the present study was to examine the mediating roles of partner and participant catastrophizing and self-efficacy in the association between partner solicitousness and pain intensity, as well as that of dyadic adjustment in the association between solicitous and negative partner responses and sexual satisfaction. The present study was the first to examine potential mediators of these associations in couples where the woman has PVD or self-reported symptoms that are consistent with PVD. The first set of results indicated that, when controlling for depression and partner-perceived solicitousness, participant catastrophizing and self-efficacy partially mediated the association between higher participant-perceived solicitous responses and higher pain intensity in women with PVD. Similarly, controlling for depression and participant-perceived partner solicitousness, partner catastrophizing and self-efficacy partially mediated the association between higher partner-perceived solicitous responses and higher pain intensity in women with PVD. However, for both women and partners, only pain catastrophizing was a unique mediator.

The finding that catastrophizing partially mediated the relationship between solicitous partner responses and pain intensity in women with PVD, for both participant- and partner-perceived responses was consistent with Sullivan et al.'s (2001) CCM. The

CCM posits that social factors, such as partner responses, may lead to the development and maintenance of catastrophizing. In other words, partner responses to participant pain may serve to trigger, maintain or reinforce participant catastrophizing. In turn, catastrophizing may inadvertently worsen the pain via increased attention to the pain experience. In the context of PVD, solicitous partner responses may generate cognitions that the pain is uncontrollable and may lead to further avoidance of sexual activity, a factor known to increase pain intensity in women with PVD (Desrochers et al., 2009). An overly solicitous partner may also be more likely to use avoidant coping himself, further reinforcing his own or his partner's catastrophic interpretations of the pain. Another assertion of the CCM is that catastrophizing elicits partner responses in order to maximize proximity or solicit assistance and empathy from others, and these responses increase pain (Sullivan et al., 2001). This hypothesis has been tested directly in only one study, which did not find support for the mediating role of participant-perceived solicitousness in the association between participant catastrophizing and pain intensity in a sample of people with chronic pain (Buenaver et al., 2007). Our results provided preliminary support for the direction of the interrelationships that may exist among solicitous partner responses, catastrophizing, and pain.

A notable contribution of this study was that the partner's perception of his own responses and his own level of catastrophizing about participant pain was significantly associated with pain intensity in women with PVD. In fact, partner-perceived solicitousness was more strongly associated with pain intensity in women with PVD than was participant-perceived solicitous responses, which is consistent with prior research (Rosen et al., 2010). Certain factors, such as awareness of responses, emotions related to the responses, and motivation to respond, may influence perceptions of partner responses (Stone et al., 2000). It is possible that partners may have a more accurate awareness of their own response patterns and this could explain why partner-perceived responses were a better predictor of pain in women with PVD. It is also plausible that women and partners have different motivations for how they perceive partner responses and these motivations may differentially influence perceptions of partner responses and the subsequent impact on women's pain experience. For example, women may be motivated to view their partners as solicitous because it decreases any feelings of guilt or anxiety for not engaging in intercourse and may reinforce their preference for avoiding sexual activity. In contrast, partners may be motivated to view their own responses as solicitous because they view these responses as positive and desirable. It is possible that both partners may be susceptible to social desirability in their reports of solicitousness, which should be controlled for in future studies.

The present results were important given the paucity of dyadic research on the CCM, chronic pain, and sexuality in general, and PVD in particular, that incorporates and controls for

the perspective of both the participant and the partner in a single study. The experience of pain does not impact the person experiencing the pain in isolation; rather, the pain has psychological, sexual, and interpersonal repercussions for both the individual with pain and the partner. The partner's own catastrophizing about the woman's pain may negatively affect the partner's ability to attend to and support the needs of the person in pain (Cano, Leong, Heller, & Lutz, 2009), thereby increasing the individual's pain. In the context of sexual activity, a catastrophizing partner may behave in an inhibited manner, thereby contributing to a sub-optimal sexual interaction, which may diminish both partners' capacity to steer focus away from pain and toward alternative sexual activities.

Further, investigating the comparative influence of participants' or partners' perception of variables in the same study may have implications for choosing appropriate measures in future research, as well as affect our confidence that the behavior is being accurately measured by asking only one of the two partners (Pence, Cano, Thorn, & Ward, 2006). The current result that both participant- and partner-perceived catastrophizing acted as partial mediators was consistent with the limited data on dyadic agreement in chronic pain couples (Pence et al., 2006) and with a recent PVD study (Rosen et al., 2010). The fact that partner-perceived variables can influence women's pain has two implications: (1) it supports the integration of partner variables into biopsychosocial models of PVD and, (2) given that prior psychological treatment studies for PVD have not included the partners, these findings suggest that psychological couple interventions targeting the cognitive and behavioral processes of both women and their partners, need to be developed and empirically tested.

Although self-efficacy contributed to the overall partial mediation effects, it was not a unique mediator of the relationships between solicitous responses and pain intensity. This finding was surprising given that several chronic pain researchers have demonstrated that self-efficacy significantly predicted pain intensity (Porter et al., 2008; Woby et al., 2007) and, further, that catastrophizing is negatively correlated with self-efficacy appraisals for controlling or decreasing pain (Desrochers et al., 2009; Geisser, Robinson, & Riley, 1999). However, Desrochers et al. (2009, 2010) have reported some inconsistent results regarding the role of self-efficacy in PVD pain. In one study, they reported that lower self-efficacy contributed to the total variation in increased intercourse pain; however, it was not a significant independent predictor.

In a second study, Desrochers et al. found that higher pain self-efficacy did contribute unique variance to lower pain following a topical or psychological treatment intervention. It is possible that self-efficacy may be less important than catastrophizing in predicting pain when the pain is elicited within a social context, such as PVD. As noted, both partner responses and catastrophizing serve social purposes and their effects are therefore best inter-

preted within an interpersonal framework. In contrast, self-efficacy may reflect more intra-individual processes and therefore be less influential in understanding the relationship between dyadic variables and women's pain and psychosexual outcomes. A strength of the current study was that the proposed mediators were tested in a multiple mediator model which allowed for a comparison of the relative influence of the proposed mediators. Our results corroborated prior research indicating that catastrophizing is a more significant cognitive variable in chronic pain populations (Keefe et al., 2000). Still, given the inconsistent findings regarding the impact of self-efficacy, further research is needed to clarify its role in couples where the woman suffers from PVD.

The second set of results from the present study indicated that with respect to sexual satisfaction, controlling for depression, sexual function, and partner-perceived solicitousness, dyadic adjustment partially mediated the association between higher participant-perceived solicitous responses and higher sexual satisfaction, and fully mediated the association between higher participant-perceived negative responses and lower sexual satisfaction. Although dyadic adjustment is known to be a major factor influencing sexual satisfaction, the results from this study were the first to provide support for the mediating role of dyadic adjustment in the association between participant-perceived partner responses and sexual satisfaction. This finding provides empirical support for the hypothesis put forth by prior researchers (Desrosiers et al., 2008; Meana, Binik, Khalifé, & Cohen, 1998; Rosen et al., 2010). Specifically, it has been proposed that solicitous responses may lead to greater sexual satisfaction because women interpret these responses as reflecting partner sensitivity and understanding of their pain, resulting in greater sexual satisfaction. In contrast, women may interpret negative partner responses as a lack of sensitivity to their pain, thereby creating a detrimental context for sexual activity, resulting in lower sexual satisfaction. Dyadic adjustment reflects the level of satisfaction with the overall relationship, including its sexual aspects. Thus, dyadic adjustment may give rise to higher or lower sexual satisfaction in women with PVD because, for example, couples may be more or less likely to focus on sexual activities other than penetration (Farmer & Meston, 2007) or on the emotional benefits of sexual activity (e.g., intimacy, closeness) (Rosen et al., 2010). Given that dyadic adjustment is a complex construct, future studies may wish to isolate what aspects of dyadic adjustment, such as partner sensitivity, expression of empathy, or level of intimacy, are specifically at play.

It is important to note some limitations of the present study. First, the study selection criteria corresponded to a diagnosis of PVD; however, a portion of the participants were not diagnosed through a standardized gynecological examination. In this case, their diagnosis was self-reported. Symptom self-report in women with PVD has been found to be significantly related to receiving a diagnosis of PVD from a physician (Reed et al., 2006). Second, our sample consisted of heterosexual, cohabitating couples and

the mean age of participants was higher than most studies of women with PVD. Future studies should include a more heterogeneous sample (e.g., homosexual couples, younger couples or those in newer relationships) to improve the generalizability of the findings. Third, it is possible that the type of compensation offered may have affected who chose to participate. Fourth, the mediation models tested in this study, especially the model predicting sexual satisfaction, were for the most part empirically rather than theoretically driven. Finally, causal associations among the variables of interest cannot be established. Nonetheless, the present results, in combination with the non-significant mediation results of Buenever et al. (2007), provide preliminary support for the temporal order of the associations among solicitous partner responses, catastrophizing, and participant pain. Future research should include longitudinal and experimental designs, such as observational and experience processing methods, in order to assess directly the interactions of couples and establish more firmly the causal order of the variables of interest.

In spite of these limitations, the present study provides support for partial mediational models in which (1) the association between participant- and partner-perceived solicitous partner responses and pain intensity during intercourse were partially accounted for by catastrophizing and self-efficacy, with catastrophizing accounting for unique variance in the associations for both participant- and partner-perceived variables, and (2) the association between participant-perceived solicitous and negative partner responses and sexual satisfaction was partially and fully accounted for by dyadic adjustment. Given that the results indicated partial mediation effects, future research should investigate other potential mediating psychosocial variables in the relationship between solicitous responses and pain (e.g., cognitions about vaginal penetration, fear of pain) and in the relationship between partner responses and sexual satisfaction (e.g., intimacy, sexual communication). Further, prior research has suggested that receiving support that matches one's desired type of support leads to better coping outcomes (Cutrona & Russell, 1990). Thus, individual's expectations or reported satisfaction with the type of partner response or amount of support provided may additionally mediate the aforementioned relationships. In conclusion, the current findings suggest that catastrophizing and dyadic adjustment may constitute a route by which partner responses exacerbate pain and increase or decrease sexual satisfaction. The results aid in identifying meaningful targets for psychological interventions with couples. Specifically, the current findings suggest that reducing catastrophizing and increasing dyadic adjustment could lead to improvements in pain and sexual satisfaction, respectively (Cano et al., 2000).

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