

Daily Associations Between Partner Responses and Sexual and Relationship Satisfaction in Couples Coping with Provoked Vestibulodynia

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ABSTRACT

Introduction. Women with provoked vestibulodynia (PVD) experience a recurrent vulvo-vaginal pain triggered primarily during sexual intercourse. Although affected couples report adverse effects on their sexual and global romantic relationships, few studies have examined interpersonal factors that may influence their sexual and relationship satisfaction. Cross-sectional studies have shown that greater partner solicitous and negative responses and lower facilitative responses are associated with poorer sexual and relationship satisfaction in women with PVD.

Aim. The aim of this study was to investigate the within-person associations between partner responses to painful intercourse and the sexual and relationship satisfaction of affected couples.

Methods. In a dyadic daily experience study, 69 women ($M_{\text{age}} = 28.46$, $SD = 6.66$) diagnosed with PVD and their cohabitating male partners ($M_{\text{age}} = 30.29$, $SD = 8.13$) reported on male partner responses, as well as sexual and relationship satisfaction on sexual intercourse days ($M = 6.81$; $SD = 5.40$) over 8 weeks.

Main Outcome Measures. Dependent measures were the (i) Kansas Marital Satisfaction Scale and (ii) Global Measure of Sexual Satisfaction Scale.

Results. On sexual intercourse days when women perceived more facilitative partner responses than usual and on days when they perceived lower negative partner responses than usual, they reported higher sexual and relationship satisfaction. On sexual intercourse days when men reported more solicitous responses than usual, both they and their female partners reported lower sexual satisfaction.

Conclusions. Interventions aimed at improving the day-to-day sexual and relationship satisfaction of couples with PVD should target increasing facilitative and decreasing negative and solicitous partner responses. **Rosen NO, Muise A, Bergeron S, Delisle I, and Baxter ML. Daily associations between partner responses and sexual and relationship satisfaction in couples coping with provoked vestibulodynia. J Sex Med 2015;12:1028–1039.**

Key Words. Provoked Vestibulodynia; Vulvodynia; Partner Responses; Sexual Satisfaction; Relationship Satisfaction; Daily Experience Sampling

Introduction

Women with provoked vestibulodynia (PVD) experience a recurrent pain localized in the vulvar vestibule that is triggered by pressure to the area, primarily during sexual intercourse, but also

from other activities (e.g., tampon insertion). It is the most common type of unexplained vulvovaginal pain in premenopausal women, with an estimated prevalence of 8–12% in the general population [1,2]. This persistent pain adversely affects women and their partners' general well-being, quality of

life, and relationships [3,4]. Experts agree that the etiology of PVD is multifactorial, incorporating biological, psychological, and interpersonal factors, although the role of interpersonal factors has been studied less in comparison [5].

The most significant interference of the pain is to a woman's sexual life and, more broadly, to her romantic relationship, highlighting the interpersonal nature of this condition (see Rosen et al. [6] for a review). Recent literature reviews have concluded that PVD negatively impacts the self-reported sexual well-being of affected women [7,8]. In particular, women with PVD report disruptions to all aspects of their sexuality including lower sexual desire, arousal, difficulties with orgasm, and decreased frequency of intercourse in comparison with women without PVD [9–11]. Male partners of women with PVD have been found to experience more erectile difficulties compared with a control group [12,13]. Both members of affected couples report lower sexual satisfaction compared with pain-free controls or scale norms [8,12,14]. Sexual satisfaction captures the emotional and relational aspects of a sexual interaction in contrast to sexual functioning, which focuses on the intraindividual sexual experience, including psychophysiological phenomena such as vaginal lubrication [15]. It is therefore important to examine sexual satisfaction as a distinct construct. Indeed, sexual satisfaction has been found to be more strongly associated with interpersonal variables (e.g., couple intimacy) than has sexual function [16], including in samples of women with PVD [17].

The majority of studies have found that women with PVD and their male partners do not experience lower relationship satisfaction compared with control groups or scale norms [12,18–23]. However, some studies have found significantly poorer relationship satisfaction in women with PVD compared with pain-free controls [10,21,24]. Still, this pain negatively affects the women's ability to feel close to and show affection for their partners [25]. Qualitative studies have depicted women's feelings of guilt, shame, inadequacy as a partner [26], and a strong fear of losing or disappointing their partner because of PVD-related pain [27,28]. Similarly, male partners have reported a negative toll on their relationships due to their female partners' genital pain [12]. Taken together, such findings indicate that PVD can significantly strain a relationship, warranting further investigation of factors associated with relationship satisfaction.

One significant gap in the empirical literature concerns studies examining factors that may influence the sexual and relationship satisfaction of women with PVD and their partners [8]. Interpersonal factors, such as partner support, partner responses to pain, and couple verbal communications, are known to influence the risk for developing and maintaining chronic pain conditions and associated consequences [29,30]. Interpersonal factors are especially relevant to PVD because a partner may elicit the pain during sexual activity, observe the woman's pain, and have their own emotional and behavioral reactions to the pain [4,12]. Moreover, couples may collude, either knowingly or unintentionally, in their avoidance of both painful and nonpainful sexual activities as well as other forms of intimacy such as affectionate touching [26,31]. This avoidance may contribute to relationship difficulties such as feelings of invalidation in both partners [32]. Knowledge regarding the role of interpersonal factors, particularly their impact on couples' sexual and relationship satisfaction, has only recently received attention in the area of PVD. Lower intimacy and having an insecure attachment style have been associated with lower sexual satisfaction in women with PVD [33,34]. Similarly, lower dyadic sexual communication has been linked to poorer relationship satisfaction in women with genital pain and their male partners [13].

The way a partner responds to a woman's pain during or after intercourse is the interpersonal variable that has been investigated most thoroughly [6]. Partner responses can be solicitous (providing attention and sympathy), negative (expressions of hostility and frustration), and facilitative (expressing affection and encouraging adaptive coping). For example, a solicitous response might be a partner suggesting stopping all sexual activity, a negative response would be a partner expressing anger, and a facilitative response would be a partner expressing happiness that the woman is engaging in sexual activity. Cross-sectional studies have shown that greater partner solicitous and negative responses and lower facilitative responses are associated with poorer relationship satisfaction in chronic pain patients [35,36], and poorer sexual and relationship satisfaction in women with PVD [37,38]. According to Fordyce's [39] operant behavioral model, patient pain behaviors communicate pain to a partner who may respond in a reinforcing or punishing manner, with subsequent consequences for the patient's pain experience and adjustment [40,41]. An alternative explanation is

that partner responses may impact the emotional regulation and intimacy of the couple, with effects on patient pain and psychosocial adjustment [30,32].

The study of partner responses in chronic pain, and in PVD specifically, has recently been extended in two important methodological ways: the use of dyadic and within-person study designs. First, separate reports from both members of the couple are required in order to isolate the effects of male partner responses perceived by the woman from those reported by the male partner himself. Given the well-established social context of pain [29,42,43], such dyadic designs allow one to control for the perspective of both members of the couple and the interdependent nature of sexual interactions, while examining the level of adjustment in both women and partners. Second, partner responses and associated impairments have been found to vary across interpersonal interactions in chronic pain populations [44,45]. A within-person study design is better able to capture the individuals' unique thoughts, emotions, and behaviors across multiple sexual experiences while reducing recall biases as couples are reporting on their sexual experiences as close in time as possible to when the experiences actually occurred. In the first dyadic daily experience study with PVD couples, Rosen and colleagues examined associations between partner responses and self-reported sexual functioning (sexual initiation/receptivity, arousal, orgasm, pleasure, and satisfaction). They found that on days when women perceived greater facilitative, lower solicitous, and lower negative male partner responses than usual, and when male partners reported lower solicitous responses than usual, women's sexual functioning increased. On days when male partners reported lower solicitous and negative responses than usual, their sexual functioning increased [46]. Further, on days when women perceived greater negative male partner responses than usual, they reported more depressive symptoms [47]. No studies have examined the daily associations between male partner responses and couples' sexual and relationship satisfaction in PVD, which are two core relational outcomes in this population.

Aims

The current study consisted of an 8-week Internet-based daily experience study of women with PVD and their male partners. The aim was to investigate the within-person associations between

male partner responses to painful intercourse and the sexual and relationship satisfaction of affected couples. It was hypothesized that on days of sexual intercourse when women perceived greater facilitative, and lower negative and solicitous male partner responses than usual, they would report higher sexual and relationship satisfaction. It was further hypothesized that on days of sexual intercourse when male partners reported greater facilitative, and lower negative and solicitous partner responses than usual, women would report higher sexual and relationship satisfaction. The primary hypotheses predicted associations between male partner responses and women's sexual and relationship satisfaction. However, based on the limited available literature, corresponding effects for male partners' satisfaction were expected to show similar patterns.

Methods

Participants

North American women were recruited at regularly scheduled clinical appointments to the coinvestigator physicians (21%), through print and online advertisements (70%), and by word of mouth (9%). There were no differences between recruitment groups on any sociodemographic variables. First, women's eligibility was assessed in a structured interview by telephone. They were asked to confirm their partners' participation. Second, women were scheduled for a gynecological examination if they had not been recruited after a clinic appointment. The inclusion criteria for women were as follows: (i) pain during intercourse, which was subjectively distressing, occurs(ed) on 75% of intercourse attempts in the last 6 months and had lasted for at least 6 months; (ii) pain limited to activities involving pressure to the vestibule; (iii) cohabitating with a male partner for at least 6 months; and (iv) pain during the PVD diagnostic gynecological examination, which involved a validated, standardized form of the "cotton swab test" [48]. The examination included a randomized palpation using a dry cotton swab of three locations around the vestibule surrounding the hymeneal ring (i.e., 3–6–9 o'clock), to which participants rated their pain at each site on a scale of 0 (*no pain*) to 10 (*worst pain ever*). Exclusion criteria included the presence of one of active infection previously diagnosed by a physician or self-reported infection, vaginismus (involuntary tightness of the pelvic floor muscles during attempted penetration, as defined by DSM-IV-TR), pregnancy, age less than

18 or greater than 45 years (in order to ensure women were premenopausal), and non-English fluency. The inclusion criterion for male partners was age greater than 18 years, and the exclusion criterion was non-English fluency. Of 126 interested participants, 45 (36%) were ineligible: 19 (42%) were not in a relationship, nine (20%) partners declined participation, eight (18%) did not receive a diagnosis of PVD by the gynecologist, and nine (20%) were ineligible for other reasons (e.g., non-English speaking, pregnant). Of the 82 (65%) women who met eligibility criteria and agreed to participate along with their partners, eight (10%) couples reported not engaging in intercourse during the study, one (1%) woman became pregnant, and four couples (5%) dropped out, resulting in a final sample size of 69 couples.

Procedure

Couples attended an orientation session where they each provided informed consent. They subsequently completed online questionnaires assessing demographic information and self-report measures unrelated to the current study. Participants were asked to complete the daily diaries for 8 consecutive weeks through links to a secure survey site that was emailed individually to each participant. They were instructed to begin the diaries that same day and to complete them at the same time each day (reflecting on the previous 24 hours) and independently from their partner. Several strategies were implemented to promote diary completion: (i) a research assistant called participants three times a week as a reminder; (ii) participants were given a reminder flyer to post in their home; and (iii) during the orientation session, a research assistant helped participants to create implementation intentions for their daily goal of completing a diary. Implementation intentions are if-then statements detailing the when, where, and how of attaining a goal and have been found to enhance the uptake of a new behavior [49]. This research protocol resulted in only four couples dropping out, representing an attrition rate of 5%.

Daily measures included variables not relevant to the present study, as well as an item about whether or not the participant engaged in sexual intercourse in the preceding 24 hours. If the participant indicated that sexual intercourse had occurred, then women completed measures of perceived male partner responses to her pain, men completed measures of their own responses to the woman's pain, and both members of the couple

completed measures of sexual and relationship satisfaction. The overall rate of diary completion was 86.12% (6,655 diaries of a possible 7,728), with a mean number of 6.81 (SD = 5.40; range = 1–30; median = 5.00) sexual intercourse events over the course of the study. The online survey software tracked the timing of diary completion, and participants were also asked to enter the date they completed the diaries. Of 921 sexual intercourse diaries (1,842 diaries total), five (<1%) sexual intercourse diaries indicated a mismatch of more than 24 hours between the participant-reported time of completion and the time stamp, and 22 (2%) sexual intercourse diaries indicated with the time stamp that participants were completing more than one diary on the same day and time. The aforementioned instances of diary completion were considered to be invalid, and these days were removed prior to analyses. Some participants reported a lack of Internet access over the 8-week course of the study (e.g., due to travel). Of the 894 valid sexual intercourse diaries, 153 (9%) were therefore completed by paper and pen (by 27 participants, 15 couples). To maintain confidentiality, participants entered the data themselves once they had access to the Internet. Although the integrity of these data cannot be specifically verified, studies have shown that both paper and electronic diary methods yielded data that were comparable in compliance rates, psychometric properties, and pattern of results [50]. Together with the low rate of invalid data (less than 3%) for the electronic diaries, we elected to include diaries completed both electronically and by paper in our analyses, resulting in 894 valid sexual events, reported by 138 participants (69 couples). As compensation, each participant received \$20 for completing the orientation session and \$12 per week for the diaries (\$116 total). Our university health centre's institutional review board approved this study.

Measures

Partner Responses

Women's perceived partner responses refer to the perception of her male partner's responses to her pain during intercourse, whereas men's self-reported partner responses refer to their perception of their own responses to the woman's pain during intercourse. Solicitous and negative partner responses were measured with the well-validated Significant Other Response Scale, a subscale of the West Haven-Yale Multidimensional Pain Inventory (MPI) [51] and the partner version of this

scale [52]. These scales assess perceived solicitous (six items, e.g., “comforts me”) and negative (four items, e.g., “expresses frustration at me”) responses. Items were previously adapted for women with PVD and their male partners [17], and shown to maintain the original factorial structure of the measures. The instructions were modified slightly for the daily context. Participants reported the frequency of male partner responses on a scale ranging from 1 (*never*) to 6 (*very frequently*), with higher scores indicating a greater frequency. Scores could range from 6 to 36 on the solicitous and 4 to 24 on the negative subscales. Both scales demonstrated good reliability with alphas of 0.76 and 0.84 for women and 0.77 and 0.79 for partners, for the solicitous and negative subscales, respectively.

Facilitative partner responses were measured with the well-validated facilitative subscale of the Spouse Response Inventory and the partner version of this scale [53]. Items were previously adapted to women with PVD (six items; e.g., “tells me that I am pleasuring him” [38]) and their male partners, and shown to maintain the structure of the original measure. Respondents indicated facilitative male partner responses to the woman’s pain during intercourse, on a scale ranging from 1 (*never*) to 6 (*very frequently*). The instructions were modified slightly for the daily context. Scores could range from 6 to 36. Higher scores indicate a greater frequency of partner responses. Alphas were 0.93 and 0.96 for women and partners, respectively.

Sexual Satisfaction

Women and men’s sexual satisfaction was assessed with the Global Measure of Sexual Satisfaction scale, which has good psychometric properties [15]. This scale consists of five items assessing whether or not sexual experiences are good vs. bad, pleasant vs. unpleasant, positive vs. negative, satisfying vs. unsatisfying, and valuable vs. worthless on a seven-point Likert scale. The instructions were modified slightly for the daily context. Summed responses yielded a daily total score whereby higher scores indicated greater satisfaction, and total scores could range from 5 to 35. The alpha was 0.96 for both women and partners.

Relationship Satisfaction

Women and men’s relationship satisfaction was assessed with the Kansas Marital Satisfaction Scale (KMSS [54]). This brief scale was chosen to reduce participant burden, which is a common concern in

daily experience studies. It consists of three items that were modified slightly for cohabitating (but not necessarily married) couples and for the daily context. The items included “how satisfied are you with your relationship with your partner today?,” “how satisfied are you with your partner today?,” and “how satisfied are you with your overall marriage/common-law relationship today?” Ratings were made on a scale of 1 (*very unsatisfied*) to 7 (*very satisfied*), and summed responses yielded a daily total score (with a possible range of 3–21), whereby higher scores indicated higher satisfaction. Prior studies have established the internal consistency, test–retest reliability, and concurrent and discriminant validity of the KMSS [54]. Alphas were 0.95 and 0.97 for women and partners, respectively.

Data Analysis

Data were analyzed with multilevel modeling using mixed models in *SPSS* 20.0 (SPSS Inc., Chicago, IL, USA). The Actor Partner Interdependence Model guided the analyses [55]. All models included women’s perceptions of their partner’s solicitous, negative, and facilitative responses, and men’s reports of their own solicitous, negative, and facilitative responses. In the analyses, we assessed the associations between women’s perception of male partner responses and their own sexual and relationship satisfaction (i.e., actor effect) and the association between men’s report of their own responses and women’s sexual and relationship satisfaction (i.e., partner effect). Similarly, the associations between women’s perception of male partner responses and men’s report of their own responses on men’s sexual and relationship satisfaction were examined. We tested a two-level cross model with separate random intercepts for men and women, where persons are nested within dyads, and person and days are crossed to account for the fact that both partners completed the daily surveys on the same days [55]. All daily-level predictors were person-mean centered such that coefficients reflect associations between deviations from a person’s mean score on each partner response variable and each outcome measure [56,57]. As such, these analyses account for between-person differences in partner responses and assess whether day-to-day changes from a participant’s own mean on the partner response variables are associated with changes in sexual and relationship satisfaction. Given that the partner responses are in relation to pain during

intercourse, the analyses focused on days when vaginal intercourse was reported.

Results

Sample Demographics and Intercorrelations

Women who were included in the analyses were no different from those who were excluded (i.e., the four couples who dropped out and the eight who did not have intercourse) in terms of relationship status and household income. Included women were younger, $b = -6.33$, $t(76) = -2.77$, $P = 0.01$, less educated, $b = -2.83$, $t(76) = -3.04$, $P = 0.01$, and had been experiencing pain for a shorter period, $b = -4.50$, $t(76) = 2.87$, $P = 0.01$, than those who were excluded. Table 1 presents descriptive statistics for the participants and for both partners' daily measures, which are aggregated within person across all diaries. Men reported significantly higher sexual satisfaction than women, $b = 0.85$, $t(610.83) = 6.05$, $P < 0.001$, but there were no other significant gender differences on the independent or dependent variables. Relationship duration, pain duration, and average pain intensity were not correlated with sexual satisfaction or relationship satisfaction. Table 2 depicts the within-person correlations between all independent and dependent variables. Women's perceived solicitous partner responses and men's reported solicitous responses were moderately correlated ($r = 0.43$, $P < 0.001$); women's and men's negative responses were correlated at low levels ($r = 0.20$, $P < 0.001$), and women's and men's facilitative responses were low to moderately correlated ($r = 0.33$, $P < 0.001$). In addition, women's sexual and relationship satisfaction were positively correlated at low to moderate levels ($r = 0.24$, $P < 0.001$), as were men's sexual and relationship satisfaction ($r = 0.21$, $P < 0.001$). Finally, women's and men's reports of sexual and

Table 1 Descriptive statistics for the sample (N = 69 couples)

Characteristic	M (range) or N	SD	%
Age (years)			
Women	28.46 (18–45)	6.66	—
Men	30.29 (19–55)	8.13	—
Education level (years)			
Women	16.22 (11–24)	2.75	—
Men	15.65 (11–24)	2.76	—
Relationship status			
Married	—	—	55
Cohabiting	—	—	97
Relationship length in years	5.95 (0–25)	5.39	—
Pain duration in months	70.85 (6–228)	54.89	—
Average pain intensity	4.21 (1–10)	2.53	—
Couple's annual income (\$)			
0–19,999	—	—	8
20,000–39,000	—	—	21
40,000–59,000	—	—	18
60,000 and over	—	—	53
Religion			
Women			
Catholic	—	—	25
Other	—	—	57
No religion	—	—	18
Men			
Catholic	—	—	22
Other	—	—	58
No religion	—	—	20
Independent variables			
Solicitous			
Women	10.05 (4.00–26.00)	4.75	—
Men	10.68 (4.00–23.00)	6.49	—
Negative			
Women	4.41 (4.00–6.86)	0.73	—
Men	4.22 (4.00–7.80)	0.67	—
Facilitative			
Women	27.37 (10.29–36)	7.40	—
Men	26.459 (6.00–36)	7.53	—
Dependent variables			
Sexual satisfaction			
Women	24.60 (8.43–35.00)	6.49	—
Men	26.04 (5.50–35.00)	7.22	—
Relationship satisfaction			
Women	17.89 (6.20–21.00)	2.90	—
Men	18.01 (7.06–21.00)	3.03	—

Possible ranges for questionnaire measures: solicitous: 6–36; negative: 4–24; facilitative: 6–36; sexual satisfaction: 5–35; relationship satisfaction: 3–21. Religion was an open-ended question. Responses that were included as "other" were non-Catholic Christian, Jewish, Muslim, atheist, agnostic, and no religion. —, not applicable

Table 2 Correlations between all independent and dependent variables

	1	2	3	4	5	6	7	8	9	10
Women's solicitous	—	0.09*	0.32***	0.03	-0.01	0.43	0.06	0.22***	-0.07	-0.03
Women's negative		—	-0.22***	-0.27***	-0.18***	0.18***	0.20***	0.08	-0.13**	-0.06
Women's facilitative			—	0.20***	0.22***	0.05	-0.12**	0.33***	0.04	0.06
Women's sexual sat				—	0.24***	-0.14**	-0.03	0.02	0.19***	0.01
Women's rel sat					—	-0.08	-0.02	0.08	0.11*	0.26***
Men's solicitous						—	0.15**	35**	-0.17***	-0.02
Men's negative							—	0.05	-0.09*	-0.04
Men's facilitative								—	-0.02	0.07
Men's sexual satisfaction									—	0.21***
Men's relationship satisfaction										—

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$; correlations are between within-person variables

relationship satisfaction were low to moderately correlated ($r = 0.19$ and $r = 0.26$, respectively, both $P_s < 0.001$).

Within-Person Effects of Male Partner Responses on Women’s Sexual and Relationship Satisfaction

Our first set of predictions concerned the association between male partner responses to women’s pain (women’s perceived responses and men’s reported responses) and women’s sexual and relationship satisfaction. Consistent with our hypotheses and as depicted in Table 3, on days of sexual intercourse when women perceived more facilitative responses than usual, they reported higher sexual and relationship satisfaction, and when they perceived more negative partner responses than usual, they reported lower sexual and relationship satisfaction. On days when men reported more solicitous responses than usual, their female partners reported lower sexual satisfaction. Finally, on days when men reported more facilitative partner responses than usual, their female partners reported marginally higher relationship satisfaction. There were no other significant effects of women’s or men’s reported partner responses on women’s sexual or relationship satisfaction. Given that sexual function is associated with sexual and relationship satisfaction in women with PVD [38], the models were examined controlling for this variable. All results remained the same.

Within-Person Effects of Male Partner Responses on Men’s Sexual and Relationship Satisfaction

Our second set of predictions concerned the association between male partner responses to women’s pain (women’s perceived responses and men’s reported responses) and men’s sexual and relationship satisfaction. On days when men reported more solicitous responses than usual, they reported lower sexual satisfaction. There were no other significant effects of women’s or men’s reported partner responses on men’s sexual or relationship satisfaction.

Discussion

This study investigated the daily associations between facilitative, negative, and solicitous male partner responses and sexual and relationship satisfaction in couples coping with PVD. To our knowledge, this was the first investigation of the within-person associations between partner responses and sexual and relationship satisfaction in PVD, which are two cores features of intimate

Table 3 Within person effects of male partner responses and sexual and relationship satisfaction

	Own sexual satisfaction			Partner’s sexual satisfaction			Own relationship satisfaction			Partner’s relationship satisfaction		
	<i>b</i>	SE	95% CI	<i>b</i>	SE	95% CI	<i>b</i>	SE	95% CI	<i>b</i>	SE	95% CI
Women’s perceived partner responses												
Solicitous	-0.01	0.07	-0.13, 0.13	0.00	0.07	-0.13, 0.13	-0.05	0.03	-0.11, 0.01	-0.02	0.03	-0.07, 0.04
Negative	-0.51**	0.18	-0.86, -0.15	-0.14	0.18	-0.64, 1.71	-0.19†	0.10	-0.38, 0.01	-0.05	0.08	-0.22, 0.11
Facilitative	0.13*	0.05	0.03, 0.23	0.04	0.05	-0.06, 0.15	0.09**	0.02	0.04, 0.13	0.02	0.02	-0.02, 0.06
Men’s reported partner responses												
Solicitous	-0.17*	0.07	-0.31, -0.03	-0.23**	0.07	-0.38, -0.09	-0.04	0.03	-0.11, 0.03	-0.04	0.03	-0.06, 0.04
Negative	-0.27	0.60	-1.45, 0.91	0.53	0.60	-0.65, 1.71	0.03	0.24	-0.44, 0.49	0.16	0.27	-0.38, 0.70
Facilitative	-0.04	0.05	-0.13, 0.05	-0.01	0.04	-0.09, 0.08	0.03	0.03	-0.01, 0.07	0.04†	0.02	-0.00, 0.08

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, † $P < 0.06$
 Degrees of freedom (d.f.) range from 346.28 to 409.73
b = unstandardized betas; CI = confidence interval; SE = standard error

relationships that are adversely affected by this condition. On sexual intercourse days when women perceived more facilitative partner responses than usual, they reported higher sexual and relationship satisfaction. Similarly, on days when men reported more facilitative partner responses than usual, their female partners reported marginally higher relationship satisfaction. On days when women perceived more negative partner responses than usual, they reported lower sexual and relationship satisfaction. For men, on days when they reported more solicitous responses than usual, they and their female partners both reported lower sexual satisfaction. Although it is possible that there is some bidirectionality in the results, findings are in line with operant learning models, showing that male partner responses to women's painful intercourse may reinforce and maintain satisfaction in pain-affected areas of a person's life. Results are also consistent with intimacy models, indicating that partner responses may affect the emotional regulation of the couple, contributing to both sexual and relationship satisfaction. This study supports a small but growing body of research demonstrating significant associations between daily psychological and interpersonal factors and the relational well-being of both partners in coping with chronic illness [58,59], including chronic pain [45,60] and PVD [46].

In the current study, on days when women perceived greater facilitative male partner responses than usual, they experienced higher sexual satisfaction. Moreover, on days when women and men reported greater facilitative responses than usual, women reported higher relationship satisfaction. These positive correlations are consistent with prior single-occasion studies (assessing partner responses from the perspective of the pain patient only) in other chronic pain populations [61] and in PVD [38]. Facilitative partner responses may help the couple to focus on the pleasurable aspects of the sexual interaction and engage in more adaptive, approach-oriented coping with the pain [38]. For example, facilitative responses may promote less painful or nonpainful sexual activities, fostering a more positive setting for an enhanced sexual experience. Prior research has shown that greater facilitative responses were associated with lower avoidance of sexual, affectionate, and pain-related behaviors (e.g., hugging/kissing a partner, talking about PVD, masturbation) [38]. Consistent with an intimacy model, sexual activities in which the woman experiences less or no pain may heighten

feelings of intimacy, a factor which is known to improve both sexual and relationship satisfaction [62,63]. Facilitative partner responses include expressions of affection and pleasure and are therefore likely to be perceived by women as positive and supportive, contributing to increased satisfaction. A recent study showed that on days where couples demonstrated more affection after sex, they reported greater sexual and relationship satisfaction [64]. Moreover, studies of women with vulvar pain have found that they report having a supportive partner as a central factor to coping well with the pain [65].

Similar to findings related to sexual functioning in women with PVD [46], on days when women perceived more negative partner responses than usual, they reported lower sexual and relationship satisfaction. Negative partner responses may interfere with the quality of the sexual interaction by reinforcing negative affective and cognitive appraisals of the pain, thus focusing couples' attention toward the pain and away from the more satisfying aspects of sex (e.g., sexual desire). Sexual encounters marked by these characteristics may reduce couple intimacy in a context whereby an intimate connection is tantamount to pleasurable outcomes, resulting in poorer sexual satisfaction for women. Consistent with intimacy models, negative partner responses may communicate a lack of empathy for the person in pain and disrupt adaptive emotion regulation [30], adversely affecting global relationship satisfaction. Indeed, recent studies have linked more negative partner responses to greater feelings of partner invalidation in couples dealing with chronic pain [32].

Men's report of greater solicitous responses than usual were associated with negative repercussions for both partners' daily sexual satisfaction. Men may engage in solicitous responses, which can include offering comfort or stopping the sexual activity, as a means of demonstrating support and concern for their female partners, unaware of the detrimental consequences of these behaviors. Based on our theoretically predicted direction of effects, men's solicitousness may encourage greater avoidance and reinforce negative cognitive-affective appraisals of pain such as catastrophizing and anxiety, elements that are known to be associated with greater pain in women with PVD [66]. Consequently, when women are in more pain, they are likely to become more distressed, which could cause them to evaluate their sexual relationship more negatively [67]. Similarly, greater pain and distress are disruptive to the sexual interaction, thus

interfering with the quality of the time spent together and leading to lower sexual satisfaction. Male partners' own solicitousness has been associated with their own greater catastrophizing about intercourse pain [37]. In turn, a catastrophizing partner may be more inhibited during sexual activities and hypervigilant to pain cues from his female partner, interfering with his ability to creatively adapt sexual activities to minimize pain and leading to lower sexual satisfaction for both members of the couple. These findings corroborate a growing number of studies demonstrating that the partners' report of their own behaviors, thoughts, and emotions are directly associated with the psychological and sexual experiences of women with PVD [46,68,69]. The results underscore the importance of including the partner in treatment efforts aimed at improving the sexual satisfaction of affected couples.

Despite the distinctly interpersonal nature of PVD because of its relation to sexuality, including both members of the couple in research has only recently gained traction. Further, only a handful of prior studies have examined partner responses to pain in the context of couples' day-to-day lives in chronic pain [44,45] and in PVD [46,47]. The novel contribution of the current study was to examine daily associations between male partner responses and sexual and relationship satisfaction in PVD, which represent key aspects of the quality of life of affected couples. The dyadic daily experience design allowed us to examine the unique effects of each partners' report of male partner responses on the sexual and relationship satisfaction of both members of the couple while reducing recall biases. It should be noted that within-person correlations between women's perception of male partner responses and men's self-report of these responses were low and low to moderate. These results are consistent with prior research on between-person dyadic agreement of partner responses [70,71]. Although neither women's nor partners' report of partner responses are necessarily a reflection of the actual behavior (i.e., both may be susceptible to biases), the low level of agreement observed in this study underscores the importance of including both members of the couple in research and treatment efforts. Future research should investigate whether within-person dyadic agreement of partner responses influences couples' sexual and relational well-being.

This study had some limitations that warrant mentioning. First, participating couples were het-

erosexual, and included women were less educated and experienced a shorter pain duration compared with women who were excluded from the study, limiting the generalizability of the findings. Results might also not generalize to participants who are peri or postmenopausal as women over the age of 45 were not included in the current study. Second, the average frequency of intercourse in the current sample was slightly higher than in prior research, potentially limiting the generalizability, although a recent report indicated that over 80% of women with PVD report regularly engaging in sexual intercourse [72]. Third, although the analyses were correlational and causal conclusions cannot be drawn, theoretically driven hypotheses guided the interpretation of the findings. Still, it is possible that there is some degree of bidirectionality in these associations such that greater sexual and relationship satisfaction lead to increases and decreases in partner responding. Future research should attempt to tease apart the temporal order and causal associations among these variables. Fourth, participants were instructed to complete diaries at the same time each day, but the timing that each individual chose varied across participants. Finally, the self-reported data in this study were still retrospective and could have been influenced by other relationship interactions that day. However, recall biases are significantly reduced with the use of daily diaries, in which participants reported their experiences as close in time as possible to when sex actually occurred.

In conclusion, in the context of penile-vaginal intercourse experiences, the current findings suggest that facilitative partner responses may improve the day-to-day sexual and relationship satisfaction of couples with PVD, whereas solicitous and negative partner responses may have deleterious effects. Consistent with interpersonal theories of chronic pain including operant and intimacy models, the results provide empirical evidence that pain does not exist in isolation and should be considered within a social context, especially with regard to its effect on interpersonal variables such as sexual and relationship satisfaction. Previous studies have shown that couples who are aware of the effects of chronic illnesses on their relationship and who strive to maintain or enhance their relationships despite such interference experience better psychosocial adaptation [73]. Indeed, couple-based psychological interventions for other sexual dysfunctions and other chronic health conditions have documented posi-

tive results [74]. Such findings illustrate the potential benefits of couple-based PVD interventions. A recent pilot study of cognitive-behavioral couple therapy for PVD demonstrated its preliminary success in reducing women's pain during intercourse and the psychosexual burden of this condition [75]. Cognitive-behavioral or intimacy-enhancing interventions may assist couples in increasing facilitative and decreasing negative and solicitous partner responses by helping couples to respond empathically to the pain and to continue to invest in their sexual relationship, perhaps by focusing on less or nonpainful activities. Clinicians might encourage couples to reflect on and identify their own experiences with partner responses to pain, and how these may impact upon their behavioral avoidance, cognitive-affective appraisals of the pain, and couple intimacy. Future research should examine the potential mediating role of these variables in the daily sexual interactions of couples with PVD, as well as in the context of treatment gains in couple therapy.

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