

## Daily Associations Among Male Partner Responses, Pain During Intercourse, and Anxiety in Women With Vulvodynia and Their Partners

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**Abstract:** Vulvodynia is a prevalent vulvovaginal pain condition that disrupts the sexual and psychological health of affected women and their partners. Cross-sectional and daily experience studies suggest that partner responses to this pain influence the psychological and sexual sequelae of affected couples. However, their daily impact on pain and anxiety remain unknown. Using a daily diary method, 69 women (M age = 28.12, SD = 6.68) diagnosed with vulvodynia and their cohabiting partners (M age = 29.67, SD = 8.10) reported on male partner responses to women's pain and anxiety symptoms on sexual intercourse days (M = 6.54, SD = 4.99) over 8 weeks. Women also reported their pain during intercourse. Results indicated that women reported greater pain on days when they perceived higher solicitous and negative male partner responses, and on days when their male partner reported greater solicitous and lower facilitative responses. Women indicated higher anxiety symptoms on days when they perceived more negative male partner responses; men's anxiety symptoms were greater on days when they reported higher negative male partner responses. Targeting partner responses may enhance the quality and efficacy of interventions aimed at reducing pain in women with vulvodynia and couples' psychological distress.

**Perspective:** This article examines the daily associations among male partner responses, women's pain during intercourse, and anxiety in couples coping with vulvodynia. Targeting male partner responses may enhance the quality of interventions aimed at reducing women's pain and the psychological distress of couples coping with vulvodynia.

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**Key words:** Vulvodynia, provoked vestibulodynia, partner responses, chronic pain, anxiety, daily diaries, couples.

The most common type of vulvodynia, an idiopathic gynecological pain condition,<sup>32</sup> is provoked vestibulodynia (PVD). PVD has a prevalence of 8 to 12% in the general population and is characterized by recurrent vulvovaginal pain triggered by pressure to the vulvar vestibule, such as during sexual activity.<sup>30,31</sup> Thus,

it is not surprising that vulvodynia has been associated with negative psychological repercussions for the couple.<sup>2,19,25,35,47,68</sup> Women with vulvodynia report higher anxiety than unaffected women,<sup>19,25,48,50,52</sup> with the diagnosis of an anxiety disorder being both a consequence and an antecedent of vulvodynia.<sup>39</sup> There are few studies of the psychological profile of male partners of women with vulvodynia and of these, some showed no differences from scale norms or a control group,<sup>20,52,73</sup> and 1 study reported greater depressive symptoms.<sup>50</sup> Still, male partners indicate a significant emotional toll of vulvodynia in their lives.<sup>15,68</sup> Biopsychosocial models of chronic pain suggest that the social environment, and especially a spouse, may contribute to maintaining chronic pain conditions and associated distress in both patients and partners,<sup>22,29,75</sup> including in vulvodynia.<sup>2,63</sup> Interpersonal variables may

Received March 13, 2015; Revised August 24, 2015; Accepted September 12, 2015.

This research was supported by a postdoctoral fellowship awarded to N.O.R. and by a grant awarded to S.B. from the Canadian Institutes of Health Research (CIHR; MOP-69063).

The authors report no conflicts of interest.

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1526-5900/\$36.00

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<http://dx.doi.org/10.1016/j.jpain.2015.09.003>

exert an important influence on adaptation to this condition because of the central role of sexuality and relationships in vulvodynia.

One interpersonal factor that may affect the couples' pain experience is partner responses to the pain. Fordyce's<sup>23</sup> operant learning theory suggests that a patient communicates pain to their significant other via pain behaviors. In turn, the partner may respond in a reinforcing or punishing manner, thus affecting the patient's pain experience. Evidence from both chronic pain<sup>13,55,56</sup> and the PVD literature<sup>20,57,58</sup> support this theory and the reciprocal nature of these interactions has been established.<sup>6,55</sup> An alternative conceptualization is that partner responses may influence the emotional regulation and intimacy of the couple.<sup>10,11</sup> Validating partner responses may allow the couple to better process and cope with aversive stimuli,<sup>24,45</sup> whereas invalidating responses may be disruptive to couples' emotional regulation, resulting in greater pain and distress.

Although other types of partner responses exist,<sup>49</sup> previous research has emphasized the detrimental impact of solicitous (instrumental support and sympathy) and negative (demonstrations of hostility) responses, and only 1 type of adaptive partner response – facilitative (encouragement of adaptive coping) – has been identified systematically.<sup>66</sup> In cross-sectional studies, greater patient-perceived partner solicitous and negative responses and lower facilitative responses are associated with greater pain in patients with chronic pain<sup>4,12,37,53</sup> and in women with PVD.<sup>20,57,58,61</sup> Greater patient-perceived negative partner responses have also been linked to more anxiety in patients with chronic pain,<sup>12</sup> potentially due to the heightened physiological arousal that may accompany stressful relationship interactions.<sup>40</sup>

Pain and psychosocial adjustment vary considerably within and across days.<sup>1,8,70</sup> Recent studies among chronic pain<sup>7,34,76</sup> and PVD populations<sup>59,60,64</sup> have utilized daily diaries to capture pain experiences that are affected by unique physical, relational, and psychological factors that change across events. Daily associations among male partner responses and the sexual and relationship well-being of couples affected by PVD have been established.<sup>59,60,62</sup> A dyadic daily experience study was conducted to investigate associations between male partner responses and women's pain during intercourse, as well as the couples' anxiety symptoms. It was hypothesized that a woman's pain and anxiety would decrease on days when she perceived greater facilitative and lower solicitous and negative male partner responses, and on days when her male partner reported greater facilitative and lower solicitous and negative responses. A similar pattern of effects was expected for men's anxiety symptoms.

## Methods

### Participants

A complete description of the recruitment procedure for this study, the inclusion/exclusion criteria, and deter-

mination of the final sample is provided in our previous papers.<sup>60</sup> Briefly, the inclusion criteria for women were the following: 1) cohabitating with a male partner for at least 6 months, 2) pain during intercourse that caused subjective distress, occurs(ed) on 75% of intercourse attempts over the last 6 months, and had lasted for at least 6 months, 3) pain resulting from pressure to the vestibule, and 4) pain during the diagnostic gynecological examination. Exclusion criteria were the following: age less than 18 years or greater than 45 years, active infection (either self-reported or previously diagnosed by a physician), vaginismus (defined by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* as involuntary tightness of the pelvic floor muscles during attempted penetration), and pregnancy. Male partners were required to be 18 years age or older. Forty-five (36%) of the 126 interested participants were deemed ineligible. Of the 81 (64%) couples who satisfied the eligibility criteria and provided informed consent, 9 (10%) couples did not engage in intercourse during the course of the study, and 3 couples (4%) dropped out, which resulted in a final sample size of 69 couples. Women who were included in the analyses did not differ from those who were excluded with regard to relationship status and household income. The women who were included were younger ( $b = -6.33$ ,  $t(76) = -2.77$ ,  $P = .01$ ), less educated ( $b = -2.83$ ,  $t(76) = -3.04$ ,  $P = .01$ ), and had experienced pain for a shorter period ( $b = -4.50$ ,  $t(76) = 2.87$ ,  $P = .01$ ) than those who were excluded.

### Procedure

The current study used data collected from a larger completed study (some results have been published previously), focusing on different patient outcomes including sexual functioning, sexual and relationship satisfaction, and depression.<sup>59,60,62,64</sup> The current article focuses on associations between male partner responses and women's pain during intercourse, which has been shown to be unrelated to indices of sexual and relationship well-being in this population,<sup>3,18,58</sup> as well as anxiety experienced by both women and partners. Detailed information regarding the study procedures can be found in our previous publications. In brief, participants were instructed to complete the daily diaries independently for 8 consecutive weeks via survey links that were emailed individually to each participant. Daily diaries included a question about whether sexual intercourse had occurred in the preceding 24 hours, as well as other measures that are not pertinent to the current study. On days when intercourse was reported in the preceding 24 hours, women completed measures of perceived male partner responses to her pain, as well as measures of pain during intercourse and anxiety symptoms, whereas men completed measures of their own responses to the woman's pain and their own anxiety symptoms. We used several methods to promote diary participation, described previously.<sup>60</sup> The total rate of diary completion was 86.12% (6655 diaries of a possible 7728), with a

mean number of 6.48 (SD = 4.94; range = 1–28) sexual intercourse events. Of 921 sexual activity diaries, 27 (<3%) diaries were considered to be invalid and were removed before the analyses. Of the 894 valid sexual activity diaries, 153 (17%) were completed by paper and pen (by 27 participants, 15 couples), and subsequently entered online by participants. Each participant was compensated \$116 at the end of the study and was provided with online and local vulvodynia resources. This study was approved by our university and health centers' institutional review boards.

## 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 partner responses refer to his self-report of his 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)<sup>38</sup> and the partner version of this scale.<sup>67</sup> The negative responses subscale (4 items, eg, "expresses frustration at me") was the same as in the original MPI. The 6 items for the solicitous subscale included in the current study were previously adapted<sup>58</sup> as follows: 2 items were the same as in the MPI (eg, "asks me how he/she can help"), 3 items were adapted to the context of PVD (eg, "tries to get me to rest" was adapted to "suggests we stop engaging in intercourse"), and 1 item ("comforts me") was added to be consistent with the defining feature of expressing sympathy, as seen in other measures of solicitous responses to pain.<sup>66</sup> The factorial structure of both subscales was maintained in the current sample. 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 subscale and 4 to 24 on the negative subscale. We applied McDonald's omega,<sup>46</sup> which is an index of the proportion of the item variance that is accounted for by the common factor relative to total variance in scores,<sup>26</sup> to assess the reliability of partner responses scores at the within-person level. The reliability estimates ranged from acceptable to high: .72 and .73 for women and .85 and .74 for partners, for the solicitous and negative subscales, respectively.

Facilitative partner responses were measured with the reliable and valid facilitative subscale of the Spouse Response Inventory and the partner version of this scale.<sup>66</sup> This scale was previously adapted for women with PVD and their male partners (6 items; eg, "tells me that I am pleasuring him"<sup>57</sup>). Respondents indicated facilitative male partner responses to the woman's pain during intercourse on a scale ranging from 1 (never) to 6 (very frequently). Scores could range from 6 to 36. Higher scores indicate a greater frequency of partner responses. Omega for women and partners was .86 and .91, respectively.

### Pain

Women reported their pain intensity, with reference to their pain during intercourse experienced in the last 24 hours, using a horizontal numerical rating scale ranging from 0 (no pain) to 10 (worst pain ever). This measure positively correlates with other pain intensity measures in PVD.<sup>18</sup> Intraclass correlation for pain scores was .53, suggesting that relatively equal amounts of variance were accounted for by individual differences in pain and by event-specific characteristics (and error).

### Anxiety

Women and men reported their general anxiety symptoms that day using the anxiety subscale of the Profile of Mood States.<sup>44</sup> This commonly used brief measure of mood has well-established reliability and validity.<sup>44</sup> The anxiety subscale consists of 4 items (on edge, uneasy, anxious, nervous) to which women and men rated the extent to which they had experienced these feelings in the past 24 hours on a 5-point scale ranging from 0 (not at all) to 4 (extremely). Responses were summed to yield a daily total score where high scores indicated greater anxiety symptoms. Omega for women's anxiety scores was .89 and for men was .83.

### Data Analysis

Correlations among women's and men's daily variables were computed. Two multilevel models were constructed to examine the hypotheses. In the first model, the dependent variable was women's pain during intercourse; in the second model, a multivariate multilevel model, both men's and women's anxiety symptoms were the dependent variables. In both models, women's perception of male partner responses to pain and men's self-reported responses to pain were the independent variables. The effects of each of these independent variables on the dependent variables were examined concurrently at both the lower level (ie, within-person) and the upper level (ie, between-person). At the within-person level, the associations between the daily values of the dependent variables (pain, anxiety) and independent variables (male partner responses) were examined; at the between-person level, the same associations were modeled based on the aggregate values over the sexual intercourse days. For ease of interpretation, the following terminology was adopted: an "actor effect" refers to the effect of a woman's perceived or a man's self-reported partner responses on their own outcome, whereas a "partner effect" indicates the effect of a woman's perceived or a man's self-reported partner responses on the partner's outcome.

The predictor variables varied both within-person and between-person. To separate the within-person effects from those at the between-person level, independent variables were centered around each person's mean or aggregated value across all sexual intercourse days; these means were then entered as predictors of the outcomes at the between-person level. Within-person centered scores represent the deviation of a person's daily score in a variable from the person's mean score

**Table 1. Demographics Statistics (N = 69 Couples, Unless Otherwise Noted)**

CHARACTERISTIC	M (RANGE) OR N	SD	%
Age, y			
Women (n = 68)	28.12 (18–44)	6.68	–
Men	29.67 (19–55)	8.10	–
Women's duration of pain in y	5.39 (0–19)	4.40	–
Education level, y			
Women	15.94 (11–24)	2.72	–
Men	15.94 (12–24)	2.69	–
Marital status			
Married	29	–	42
Relationship length, y	5.54 (0–25)	5.24	–
Frequency of intercourse (over the 8-wk study period)	6.91 (1–30)	5.40	–
Couple's annual income			
\$0–19,999	6	–	9
\$20,000–39,000	14	–	20
\$40,000–59,000	12	–	17
\$60,000 and over	37	–	54

in the same variable. For person-level predictors, group-mean centering was applied such that the centered scores represent the person's relative standing within the sample on the person-level scores. Only findings on the covariation of daily scores are discussed as this covariation represents a more precise test of our hypotheses.

The random component of the first model was structured as follows. We first considered a random intercept at the person level (ie, level 2). We then added random components for the slopes, but fixed the intercept-slope covariances at 0. As observations were temporally ordered, we next examined a first-order autoregressive error structure for the level 1 residuals. The  $\chi^2$  deviance test statistic indicated that a random intercept and a first-order autoregressive covariance provided a better fit to the model with women's pain as an outcome. For the second model, gender-specific random components for the intercept and first-order autoregressive error structure were required. Analyses were conducted using SAS version 9.3 PROC MIXED (SAS Institute Inc, Cary, NC).

The use of a sophisticated analytical procedure such as multilevel modeling, which relies on different model assumptions and estimation procedures than single level regression modeling, reduces the level of uncertainty associated with parameter estimation by taking into consideration all of the information available in the data. In addition, the current hypotheses and analyses were made a priori. Consequently, it was not necessary to make any adjustment for experiment-wise alpha inflation due to several analyses being conducted with this dataset (for a thorough treatment, please refer to.<sup>27</sup>)

**Results**

**Sample Demographics and Intercorrelations**

Table 1 presents demographics for the participants and Table 2 presents the descriptive statistics for the daily measures, aggregated within-person across all diaries. There were no significant main effects of demographic variables on women's pain or the anxiety symptoms of women or men.

Correlations among men and women's daily scores are presented in Table 2. Solicitous and facilitative male partner responses were positively correlated for women (r = .26) and men (r = .29); P < .01 for both. Solicitous and negative male partner responses were also positively correlated for women (r = .16, P < .01) and men (r = .27, P < .001). Finally, women and men's solicitous male partner responses were moderately correlated (r = .47, P < .001), negative male partner responses were correlated at low levels (r = .17, P < .01), and facilitative male partner responses were low to moderately correlated (r = .35, P < .01). Women's and men's anxiety symptoms had a small correlation (r = .17, P < .001). Women's pain intensity and women's anxiety were weakly correlated at r < .14, P < .05. Interclass correlations (ICC) indicate the proportion of variance in daily scores for a given variable that is due to person characteristics relative to daily influences (and error). With the exception of women's

**Table 2. Descriptive Statistics and Within-Person Correlations for Dependent and Independent Variables**

VARIABLES	M	SD	ICC	1	2	3	4	5	6	7	8
1. W-Sol	14.28	5.80	.55								
2. M-Sol	14.53	5.46	.60	.47***							
3. W-Fac	28.25	7.08	.67	.26**	-.02						
4. M-Fac	27.06	7.48	.65	.19**	.29**	.35**					
5. W-Neg	4.40	.70	.14	.16***	.26***	-.09	.14				
6. M-Neg	4.20	.52	.43	.06	.27***	-.16*	.04	.17**			
7. W-Pain	4.86	1.88	.53	.28***	.30***	.02	-.02	.23***	.01		
8. W-Anx	2.74	2.44	.33	.09	.10	-.03	.09	.25***	.05	.14*	
9. M-Anx	1.16	1.52	.39	.01	-.04	.05	.01	.01	.03	.03	.17***

Abbreviations: ICC, intraclass correlation; 1, Women perceived solicitous responses; 2, men reported solicitous responses; 3, women perceived facilitative responses; 4, men reported facilitative responses; 5, women perceived negative responses; 6, men reported negative responses; 7, women pain; 8, women anxiety; 9, men anxiety. NOTE. Analyses based on 894 (M = 6.91; SD = 5.40; range = 1–30) observations from 138 participants (69 couples). \*P < .05; \*\*P < .01; \*\*\*P < .001.

**Table 3. Within-Person Effects of Male Partner Responses on Women's Pain During Intercourse**

EFFECTS	B*(SE)	DEGREES OF FREEDOM	F	P	95% CONFIDENCE LIMITS, LOWER, UPPER	r†
Intercept	4.61 (.20)	62	532.69	.001	4.21, 5.01	.94
Actor_daily solicitous	.06 (.02)	371	10.79	.001	.03, .10	.17
Partner_daily solicitous	.10 (.02)	371	18.90	.001	.05, .14	.22
Actor_daily facilitative	.01 (.02)	371	.17	.68	-.03, .04	.02
Partner_daily facilitative	-.04 (.02)	371	5.68	.018	-.07, -.01	.12
Actor_daily negative	.22 (.05)	371	17.14	.001	.12, .33	.21
Partner_daily negative	-.18 (.13)	371	1.79	.18	-.45, .08	.07

NOTE. Analyses were based on 894 observations from 138 participants (69 couples).

\*Unstandardized regression coefficients.

†Effect sizes were computed using the procedure recommended by Rosenthal and Rosnow,<sup>65</sup> using the formula:  $r = \text{square root of } (F/F + df)$ .

perceived male negative partner responses, ICCs (see third column of Table 2) indicated that significant proportions of variance in daily scores were due to person characteristics.

### Within-Person Effects of Male Partner Responses on Women's Pain

Several effects emerged for partner responses on women's pain during intercourse, which were consistent with the hypotheses (Table 3). First, 2 actor effects of women's perceived partner responses on women's pain were found such that women's pain increased on days of sexual intercourse when women perceived greater solicitous and greater negative responses than usual from their male partner. Second, 2 partner effects of partners' self-reported responses emerged: women's pain increased on days of sexual intercourse when their male partner reported greater solicitous responses than usual, and decreased on days when their male partner reported greater facilitative responses than usual. The actor effect of facilitative male partner responses and the partner effect of negative responses were not significant.

### Within-Person Effects of Male Partner Responses on Women's and Men's Anxiety Symptoms

As shown in Table 4, men reported less anxiety than women across all sexual intercourse days: men,  $b = 1.41$ ,  $SE = .21$ ,  $t = 6.65$ ,  $P < .001$ ; women,  $b = 2.28$ ,  $SE = .29$ ,  $t = 7.90$ ,  $P < .001$ . Consistent with the hypotheses, actor effects emerged for male partner responses on women's anxiety symptoms and on men's anxiety symptoms. A woman's anxiety symptoms increased on days of sexual intercourse when she perceived greater negative male partner responses than usual. Similarly, a man's anxiety symptoms increased on days of sexual intercourse when he reported greater negative male partner responses than usual. All other effects of male partner responses on women's and men's anxiety were not significant.

### Discussion

In a sample of couples coping with PVD, this study examined the daily associations among solicitous, negative, and facilitative male partner responses and women's pain during intercourse, as well as the anxiety

**Table 4. Within-Person Effects of Male Partner Responses on Anxiety Symptoms of Both Women and Men**

EFFECTS	B*(SE)	DEGREES OF FREEDOM	F	P	95% CONFIDENCE LIMITS, LOWER, UPPER	r†
Intercept	1.85 (.18)	445	101.00	.001	1.49, 2.21	.43
Gender	.43 (.17)	421	6.03	.014	.09, .77	.12
Actor_daily solicitous	.00 (.02)	421	.00	.97	-.04, .04	.00
Partner_daily solicitous	.01 (.02)	421	.11	.33	-.04, .05	.02
Gender × Actor_daily Solicitous	.03 (.02)	421	1.13	.29	-.02, .07	.05
Gender × Partner_daily solicitous	-.01 (.03)	421	.10	.75	-.06, .04	.02
Actor_daily facilitative	-.01 (.02)	421	.27	.60	-.05, .03	.03
Partner_daily facilitative	.03 (.02)	421	2.35	.13	-.01, .06	.07
Gender × Actor_daily facilitative	-.01 (.02)	421	.020	.66	-.05, .03	.00
Gender × Partner_daily facilitative	.00 (.02)	421	.04	.84	-.03, .04	.01
Actor_daily negative	.31 (.10)	421	9.26	.003	.11, .52	.15
Partner_daily negative	.01 (.14)	421	.00	.97	-.27, .28	.00
Gender × Actor_daily negative	.16 (.11)	421	2.24	.14	-.05, .36	.07
Gender × Partner_daily negative	.00 (.14)	421	.00	.99	-.28, .28	.00

NOTE. Analyses were based on 894 observations from 138 participants (69 couples).

\*Unstandardized regression coefficients.

†Effect sizes were computed using the procedure recommended by Rosenthal and Rosnow,<sup>65</sup> using the formula:  $r = \sqrt{(F/F + df)}$ .



symptoms of women and partners. Consistent with our hypotheses, a woman's pain during intercourse increased on days when she perceived increased solicitous and negative male partner responses and when her male partner reported higher solicitous and lower facilitative responses. In addition, both women's and men's anxiety increased on days of greater negative partner responses. The findings contribute to an emerging number of studies indicating strong associations between daily interpersonal factors and the physical and psychological health of couples.<sup>21,33</sup> The current study is one of a few to examine such factors in the daily lives of couples living with chronic pain,<sup>1,6,70,76</sup> including PVD.<sup>59,60,62,64</sup>

The finding that women's pain during intercourse increased on days when women perceived and men self-reported increased solicitous male partner responses is consistent with previous cross-sectional studies on chronic pain<sup>43</sup> and PVD.<sup>58</sup> Experimental paradigms have also shown that greater social support, particularly from a significant other, is associated with higher experimentally induced pain sensitivity.<sup>74</sup> According to Vigil's evolutionary-based social-signaling model,<sup>75</sup> pain is heightened in the presence of romantic partners (compared with less intimate social contacts) because the person in pain is more likely to display pain behaviors, which demonstrates vulnerability. In turn, intimate partners may be most likely to provide solicitous responses to the pain sufferer.<sup>74,75</sup> Our findings support the contention that an intimate partner, through reciprocal interactions with the person in pain (ie, pain is expressed and responded to), uniquely influences the pain experience.

Operant theory suggests that solicitousness may positively reinforce patient pain behaviors (eg, avoidance) and negative cognitive-affective appraisals of the pain (eg, catastrophizing, fear of pain), which are factors known to enhance pain intensity in chronic pain<sup>42,54</sup> and PVD.<sup>18</sup> Women with PVD are typically avoidant of all displays of physical intimacy, presumably as a means of avoiding or reducing the pain.<sup>71</sup> Solicitousness may encourage this avoidance, with wider repercussions for couple intimacy. Extensive avoidance can become a reinforcing consequence over the long term, potentially by supporting cognitive appraisals that the pain must be very severe, is uncontrollable, and should be feared. Such negative appraisals may in turn contribute to heightened anxiety in anticipation of or during sexual activity, leading to decreased arousal, and more pain.<sup>5,51</sup> In a recent cross-sectional study, the association between men's reported solicitousness and women's pain during intercourse was mediated by men's greater catastrophizing.<sup>61</sup> A catastrophizing partner may be more likely to collude in avoiding sexual activity, be hypervigilant to cues of pain, and to misinterpret ambiguous signs from his partner as indicative of pain, further reinforcing women's pain behaviors and appraisals, leading to her greater pain.<sup>17,61</sup>

The results also indicated that women's pain during intercourse increased on days when she perceived more negative male partner responses. This result is in line

with a daily diary study in chronic pain couples showing that higher spouse criticism and hostility was significantly associated with greater pain concurrently, and 3 hours later, providing support for the temporal order of these associations.<sup>6</sup> Given that negative interactions promote emotion dysregulation in couples,<sup>24</sup> and lead to less intimacy,<sup>41</sup> the observed association may be explained by theories of intimacy and chronic pain.<sup>10,11</sup> Recent evidence has linked greater partner invalidation to more negative partner responses to pain.<sup>10</sup> Indeed, 1 study showed that expressions of sadness and anger by a partner were associated with greater pain severity in the person with chronic pain.<sup>36</sup> In PVD, negative male partner responses may be perceived as stressful and invalidating by women, reducing her ability to cope adaptively with the pain and turning her attention away from the pleasurable aspects of the sexual interaction, which may lead to increased pain.

Greater male partner-reported facilitative responses were associated with less daily pain during intercourse for women, consistent with previous cross-sectional studies of patient-perceived facilitative partner responses in individuals with pain and in PVD.<sup>57,66</sup> This effect is in the opposite direction to that of solicitousness, which is notable given that both types of responses are generally viewed as supportive and are positively correlated. However, solicitousness typically encourages avoidance (eg, "suggested we stop the current sexual activity"), whereas facilitative responses promote approach-oriented coping with the pain (eg, "expressed pleasure that we were engaging in any sexual activity"). In PVD, facilitative partner responses may help direct the couples' attention toward the positive aspects of the sexual interaction. Recent motivational accounts of pain suggest that the de-prioritization of pain-related goals is accompanied by a reduced processing of pain-related information.<sup>72</sup> Focusing on non-pain-related stimuli such as emotional intimacy with a partner may reduce pain processing for women, resulting in lower pain. Finally, facilitative partner responses are likely to be viewed by women as validating, fostering greater intimacy in the relationship and promoting adaptive emotion regulation during an interaction for which pain typically thwarts pleasure. A more intimate and secure context for sexual activity may enable a woman to implement coping strategies for decreasing her pain and pain-related anxiety, such as being in the present moment rather than engaging in hypervigilance and catastrophizing.

Consistent with a previous cross-sectional study in a chronic pain sample,<sup>12</sup> on days that women perceived increased negative male partner responses, they reported more symptoms of anxiety. This finding is similar to our previously reported association between greater negative partner responses and more depressive symptoms,<sup>59</sup> which is not surprising given that anxiety and depression, although distinct psychological constructs, tend to be highly correlated in this population.<sup>50</sup> Some of the mechanisms by which negative responses may elicit distress in women with PVD are therefore likely to overlap.<sup>59</sup> Given that women with PVD are known to

experience greater anxiety compared with nonclinical populations,<sup>19</sup> they may be predisposed to interpret negative partner responses to their pain as invalidating, or experience these responses as stressful in their own right, leading to enhanced physiological arousal and exacerbating any existing anxiety. Negative partner responses may convey a lack of empathy for the person in pain,<sup>10</sup> resulting in more anxiety. An observational study documented a positive association between affective distress (including anxiety) in individuals with chronic pain and their partners' expression of invalidation in response to pain-related disclosures.<sup>14</sup>

On days that men self-reported greater negative partner responses, they also reported greater symptoms of anxiety. According to empathy models, when partners of individuals with chronic pain experience their own distress, this can interfere with their ability to respond empathically.<sup>28</sup> It is also possible that partners with more anxiety may engage in more negative responses (eg, ignoring the woman's disclosures) in an attempt to deflect the woman's distress and regulate their own negative affect.<sup>14,29</sup> As for all of the partner responses, future research is needed to better understand partners' underlying motivations for responding in particular ways.

The use of daily diary methods allowed us to reduce recall biases and to examine the unique effects of each partner's report of male partner responses on women's pain and couples' anxiety symptoms. The finding that partner-reported daily variables influenced women's pain supports recent efforts to focus on the social context of chronic pain<sup>9,29,74</sup> and interpersonal factors in vulvodynia,<sup>63</sup> while underscoring the importance of including both members of affected couples in research and treatment. The results provide evidence in favor of extending models of couple communication in chronic pain to take into account that these dynamics shift across daily interactions.

The current study also has some limitations. Participating couples were heterosexual, and the women included in the study were less educated and experienced pain for a shorter duration of time compared the women who were excluded, limiting the generalizability of the findings. The data and analyses were correlational and causal conclusions cannot be drawn. Our

Daily Partner Responses, Pain, and Anxiety in Vulvodynia theoretically based hypotheses provided a foundation for interpreting the findings and are supported by experimental and prospective evidence indicating that partner responses precede pain behaviors.<sup>6,55,69</sup> However, there is likely to be some bidirectionality in the reported associations, such that women's pain and couples' anxiety may be leading to more or less solicitous, negative, and facilitative male partner responses, as indicated by previous findings with other chronic pain populations.<sup>6,55</sup> Behavioral observation and experimental studies would provide stronger evidence for the degree to which certain consequences are more or less likely to occur following particular partner responses in vulvodynia. Finally, although daily ratings were closer in time to the sexual event in comparison with cross-sectional studies, the self-reported data were still retrospective (ie, over the course of the day) and may have been influenced by other events that day.

In conclusion, solicitous and negative male partner responses may be detrimental to women's pain and the couples' experience of anxiety, whereas facilitative responses may improve women's pain. Male partner responses may alter the cognitive, affective, and behavioral reactions of women with PVD and their partners during and after painful intercourse, with potential consequences to women's pain and the psychological health of the couple. Clinically, cognitive-behavioral or intimacy-enhancing couple interventions could target partner responses in order to enhance the quality and efficacy of interventions for PVD. Indeed, promising findings have been reported for a novel cognitive-behavioral couple therapy for PVD, which explicitly targets partner responses to the pain.<sup>16</sup> Specifically, therapists may help couples to raise their awareness of their responses to a pain experience, to regulate these responses in more adaptive ways, and to cope more collaboratively with a view to increasing empathic, approach-oriented, and validating interactions.

## Acknowledgments

We are grateful to Maria Glowacka, Kayla Mooney, and Dr. Marylou Baxter for their assistance with this work.

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