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Natalie O. Rosen, Sophie Bergeron, Gentiana Sadikaj, Maria Glowacka, Isabelle Delisle, and Mary-Lou Baxter

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Impact of Male Partner Responses on Sexual Function in Women With Vulvodynia and Their Partners: A Dyadic Daily Experience Study

Natalie O. Rosen

Dalhousie University and IWK Health Centre, Halifax, Nova Scotia, Canada

Sophie Bergeron

Université de Montréal

Gentiana Sadikaj
McGill University

Maria Glowacka
Dalhousie University

Isabelle Delisle

IWK Health Centre, Halifax, Nova Scotia, Canada

Mary-Lou Baxter

QEII Health Sciences Centre, Halifax, Nova Scotia, Canada

Objective: There is a paucity of research investigating the role of interpersonal variables in vulvodynia—a prevalent, chronic, vulvo-vaginal pain condition that negatively affects many aspects of women’s sexual health, emotional well-being and intimate relationships. Cross-sectional studies have shown that male partner responses to painful intercourse are associated with pain and sexual satisfaction in women with vulvodynia. Partner responses can be solicitous (attention and sympathy), negative (hostility and frustration), and facilitative (encouragement of adaptive coping). No research has assessed the influence of daily partner responses in this population. Further, there is limited knowledge regarding the impact of partner responses on sexual function, which is a key measure of impairment in vulvodynia. **Methods:** Using daily diaries, 66 women (M age = 27.91, SD = 5.94) diagnosed with vulvodynia and their cohabiting male partners (M age = 30.00, SD = 8.33) reported on male partner responses and sexual function on days when sexual intercourse occurred (M = 6.54, SD = 4.99). Drawing on the Actor-Partner Interdependence model (APIM), a multivariate multilevel modeling approach was adopted. **Results:** A woman’s sexual functioning improved on days when she perceived greater facilitative and lower solicitous and negative male partner responses, and when her male partner reported lower solicitous responses. A man’s sexual functioning was poorer on days when he reported greater solicitous and negative responses. **Conclusions:** Findings suggest that facilitative male partner responses may improve sexual functioning whereas solicitous and negative responses may be detrimental. Partner responses should be targeted in psychological interventions aimed to improve the sexual functioning of affected couples.

Keywords: provoked vestibulodynia, pain, sexual function, partner responses, vulvodynia, dyspareunia

With a prevalence of 16% in community samples, vulvodynia is characterized by a persistent, burning, vulvo-vaginal pain, for which there are no relevant physical findings (Harlow & Stewart, 2003; Moyal-Barracco & Lynch, 2004). The most common subtype of vulvodynia is provoked vestibulodynia (PVD), which has a prevalence of 12%; a chronic, recurrent pain specific to the vulvar vestibule and elicited via pressure, in sexual and nonsexual

contexts (Moyal-Barracco & Lynch, 2004). Its etiology is multifactorial and includes biological, cognitive, affective, and interpersonal dimensions (Bergeron, Rosen, & Morin, 2011). This debilitating pain condition disrupts all aspects of women’s sexual health, and can adversely affect women and their partners’ general psychological well-being, relationship adjustment, and quality of life (Arnold, Bachmann, Rosen, Kelly, & Rhoads, 2006; Jodoin et

Natalie O. Rosen, Department of Psychology and Neuroscience, Dalhousie University, Halifax, Nova Scotia, Canada and Department of Obstetrics and Gynecology, IWK Health Centre, Halifax, Nova Scotia, Canada; Sophie Bergeron, Department of Psychology, Université de Montréal, Montréal, Québec, Canada; Gentiana Sadikaj, Department of Psychology, McGill University, Montréal, Québec, Canada; Maria Glowacka, Department of Psychology and Neuroscience, Dalhousie University; Isabelle Delisle, Department of Obstetrics and Gynecology, IWK Health Centre; Mary-Lou Baxter, Department of

Dermatology, QEII Health Sciences Centre, Halifax, Nova Scotia, Canada.

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Correspondence concerning this article should be addressed to Natalie O. Rosen, Department of Psychology and Neuroscience, Dalhousie University, 1355 Oxford Street, P.O. Box 15000, Halifax, Nova Scotia B3H 4R2 Canada. E-mail: natalie.rosen@dal.ca

al., 2008). The disability experienced by these women is reflected by impaired sexual functioning including lower desire, arousal, and frequency of orgasm and intercourse compared with women without vulvodynia (Farmer & Meston, 2007). Affected women typically score in the clinical range of sexual dysfunction for low desire and arousal (Masheb, Lozano-Blanco, Kohorn, Minkin, & Kerns, 2004). These impairments may result from the anticipation of pain, leading to greater pelvic floor hypertonicity and cognitive-affective responses that interfere with sexual function (Farmer & Meston, 2007).

Vulvo-vaginal pain is usually elicited during sexual activity with a partner, and partners also suffer sexual consequences (Jodoian et al., 2008). Overall, relationship satisfaction is not adversely affected by this condition (Smith & Pukall, 2011), nor is it associated with pain or sexual function (Rosen, Bergeron, Leclerc, Lambert, & Steben, 2010). Still, women report a fear of losing their partner and that an understanding partner is the most helpful emotional factor for coping with the pain (Gordon, Panahian-Jand, McComb, Melegari, & Sharp, 2003). Recent studies have identified several key relational variables (e.g., intimacy) that are associated with the pain and psychosexual functioning of affected couples (Bois, Bergeron, Rosen, & McDuff, 2013). Studies elucidating the interpersonal determinants of vulvodynia are lacking, and studies using within-person designs do not exist. The current study will fill this gap by investigating the daily associations between a key interpersonal variable—partner responses to women's pain—and sexual function in women with vulvodynia and their male partners.

Interpersonal variables are especially relevant to vulvodynia because partners may trigger pain during sexual activities, and they also witness and have their own reactions to the pain. Moreover, couples may collude in avoidance, which often extends beyond intercourse to include nonpainful sexual activities and other forms of intimacy (White & Jantos, 1998), and may contribute to relationship difficulties such as feelings of invalidation and inadequacy (Cano, Barterian, & Heller, 2008). Because the primary interference of vulvodynia is with sexual activity, the woman and partner each confront the problem independently, but they also face it together as an interdependent dyadic unit (Latthe, Mignini, Gray, Hills, & Khan, 2006). It is therefore important to obtain separate reports from both partners, in order to isolate the effects of male partner responses perceived by the woman from those perceived by the male partner himself. In summary, an interpersonal approach to the study of vulvodynia involves two essential components: (1) investigating relevant interpersonal variables (e.g., partner responses), and (2) controlling for the perspective of both members of the couple given the interdependent nature of their sexual interactions. There have been no prior studies examining within-person associations between partner responses and sexual function in couples with vulvodynia.

Partner Responses to Pain and Sexual Functioning

There is growing evidence that interpersonal factors affect the physical health of couples (Diamond, Hicks, & Otter-Henderson, 2011), and specifically that interpersonal factors increase the risk for developing and maintaining chronic pain conditions (Leonard, Cano, & Johansen, 2006). The communal coping model (CCM) of pain suggests that expressions of pain to significant others may

serve to evoke particular responses, such as assistance (Sullivan et al., 2001). Further, operant learning theory asserts that partners can directly influence a person's pain experience and associated disability (Fordyce, 1976). Specifically, pain behaviors (e.g., verbalizations) communicate pain to a significant other, who in turn may respond in a reinforcing or punishing manner. The spouse, as the primary witness of these displays of suffering, may thus inadvertently become a powerful reinforcing agent and contribute to increased pain and disability. Partner responses to pain can be solicitous, negative, and facilitative. For example, in vulvodynia, a solicitous response would be a partner suggesting to stop engaging in 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 any sexual activity. Affected couples typically avoid penetrative and nonpenetrative sexual activities, the latter possibly because of a fear that nonpenetrative activities will still lead to painful intercourse. A key distinction is that solicitous and negative responses promote this avoidance whereas facilitative responses encourage adaptive, approach-oriented coping, such as engaging in nonpainful sexual behaviors. Research in chronic pain (Raichle, Romano, & Jensen, 2011) and vulvodynia (Rosen, Bergeron, Glowacka, Delisle, & Baxter, 2012) supports the operant model, demonstrating that more facilitative and less solicitous and negative partner responses are associated with lower pain and disability. Although a single study investigated the impact of daily satisfaction with general supportive partner responses on arthritic pain and adjustment (Holtzman & DeLongis, 2007), to our knowledge, no studies have examined pain-related partner responses in the daily lives of people with chronic pain or vulvodynia.

A growing body of pain research suggests that it is not the pain itself, but rather the extent to which pain interferes with valued, daily activities that is the primary motivation for patients to seek treatment, and may be the key trigger for their subsequent coping and recovery (Crombez, Eccleston, Van Damme, Vlaeyen, & Karoly, 2012). Only one prior study has investigated the association between male partner responses and sexual function—the primary measure of disability in vulvodynia (Rosen et al., 2010). No associations were found between solicitous and negative partner responses and sexual function, and facilitative responses were not assessed. These findings were surprising given that previous pain studies have found a significant positive relationship between solicitous and negative partner responses and disability, although a few studies failed to find an association (Leonard et al., 2006 for review). However, the vulvodynia study used single occasion, retrospective measures, which may have introduced recall biases. Moreover, it is likely that partner responses and sexual impairments vary considerably across interpersonal interactions. The lack of significant findings may have been attributable to difficulties in capturing the complexity of the sexual experience that occurs between two individuals who each bring unique thoughts, emotions, and behaviors to the interaction.

Assessing Daily Sexual Function in Women

Sexual function in women includes the experiences of desire and arousal, orgasm, pain, and satisfaction. Most available validated questionnaires ask women to summarize and recall their sexual functioning over a period of time, such as in the

preceding month, using a self-administered questionnaire (SAQ) (Derogatis, 1997). There are several limitations to this approach, most notably an inability to capture the factors that can vary across time and sexual interactions, such as personal health or partner's sexual problems, but also more transient factors such as relationship conflict, mood, and stress (Davison, Bell, LaChina, Holden, & Davis, 2008). Studies have shown that poorer sexual functioning is associated with greater negative mood states including anxiety and depression (Lykins, Janssen, & Graham, 2006), as well as greater partner conflict (Dennerstein, Lehert, Burger, & Dudley, 1999). In sum, each sexual experience is affected by physical, relational, and psychological factors and daily experience measures are better able to capture changes in sexual function across these events.

A number of clinical trials examining female sexual dysfunction have used daily diary sexual event logs to collect information on the number of sexual events, orgasms, and sometimes level of sexual desire and sexual satisfaction (Clayton, Pyke, & Sand, 2010; Ferguson, Hosmane, & Heiman, 2010). This type of diary is useful for enumerating events, but is too simplistic and thus less reliable and valid for assessing the more subjective, multidimensional nature of women's sexual functioning (Ferguson et al., 2010). In contrast, no daily experience studies have used sexual function SAQs, perhaps for fear that this would be overly burdensome to the participants—a concern for all diary studies. For these reasons, Davison et al. (2008) developed the first validated, brief, female sexual function SAQ to be completed within 24 hours of a sexual experience. This measure provided the opportunity to address the limitations of prior research on female sexual function, and specifically in partner responses and sexual function in vulvodynia.

The Present Research

An 8-week Internet-based daily experience study of women with PVD and their partners was conducted to investigate the within-person associations between male partner responses and sexual function. It was hypothesized that, controlling for partner-reported responses, in sexual interactions when women perceived greater facilitative, and lower solicitous and negative male partner responses, they would report better sexual functioning compared to sexual interactions when facilitative responses were lower, and solicitous and negative responses were higher. Controlling for woman-perceived male partner responses, it was hypothesized that in sexual interactions when male partners reported greater facilitative, and lower solicitous and negative partner responses, women would report better sexual functioning compared with sexual interactions when facilitative responses were lower, and solicitous and negative responses were higher. The primary hypotheses predicted effects of male partner responses on women's sexual functioning, however corresponding effects for male partners' sexual functioning were expected to show similar patterns. Although the very limited available research suggests that the sexual functioning of male partners of women with PVD is typically below clinical thresholds (Jodoin et al., 2008), daily experience methods may capture more nuanced fluctuations.

Method

Participants

Women were recruited at regularly scheduled clinical appointments to the study physicians and through print and online advertisements in a North American city. The sample included 20% recruited at clinic visits, 71% recruited through advertisements, and 9% recruited by word of mouth (no differences between groups on any sociodemographic variables). Women were screened for eligibility using a structured interview and asked to confirm their partners' participation. Women were then scheduled for a gynecological examination if they had not already undergone one. The inclusion criteria for women were as follows: (1) 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, (2) pain limited to activities involving pressure to the vestibule, (3) pain during the diagnostic gynecological examination, which involved a well-validated, standardized form of the "cotton swab test"—the recommended gynecological procedure to diagnose PVD (Bergeron, Binik, Khalifé, Pagidas, & Glazer, 2001). The examination included a randomized palpation using a dry cotton swab of three locations of 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*), (4) cohabiting with a male partner for at least six months. Exclusion criteria were presence of one of the following: 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 *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision [*DSM-IV-TR*]), pregnancy, and age less than 18 or greater than 45 years. Of 123 interested participants, 45 (37%) were ineligible: 19 (42%) were not in a relationship, 8 (18%) did not receive a diagnosis of PVD by the gynecologist, 9 (20%) partners declined participation, and 9 (20%) were ineligible for other reasons (e.g., non-English speaking, pregnancy). Of the 78 (63%) women who met eligibility criteria and agreed to participate along with their partners, 11 couples reported not engaging in intercourse during the study, and one couple dropped out, resulting in a final sample size of 66 couples.

Procedure

Couples attended an orientation session where they each provided informed consent, then completed online questionnaires that included sociodemographics and self-report measures not pertinent to the present study. Participants were told that the daily diaries collected information about relationship variables, pain, and sexual functioning, which would be used for research to inform better treatment options. Participants were trained in completing the daily diaries for eight consecutive weeks through links to a secure survey server 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 supported compliance: (1) a research assistant telephoned participants three times a week to remind them to complete their diary, (2) a research assistant helped couples to create im-

plementation intentions for attaining their daily goal of completing a diary. Implementation intentions are if-then statements detailing the when, where, and how of goal attainment and have consistently been found to enhance the implementation of a new behavior (Gollwitzer & Sheeran, 2006), and (3) participants were given a reminder flyer to post in their home. This protocol resulted in only a single couple dropping out, representing an attrition rate of 1.5%. Daily measures included variables not relevant to the present study, as well as an item inquiring about whether or not the participant had vaginal intercourse in the preceding 24 hours. If the participant indicated that intercourse had occurred, then women completed measures of perceived partner responses to her pain, men completed measures of his own responses to the woman's pain, and they both completed measures of sexual function. The overall rate of diary completion was 84.74% (7118 diaries of a possible 8400), with a mean number of 6.55 ($SD = 4.99$; Range = 1–28) 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 920 sexual activity diaries, 11 (1%) indicated a mismatch of more than 24 hours between the participant-reported time of completion and the time stamp, and 45 (5%) diaries indicated with the time stamp that participants completed more than one diary on the same day. These diaries were considered to be invalid and were removed before analyses. Given the 8-week commitment that this study required, after starting the study some participants reported a lack of Internet access (e.g., for travel). Of the 864 valid diaries, 119 (14%) were therefore completed by paper and pen (by 31 participants, 17 couples). To protect confidentiality, participants were instructed to enter the data themselves once they had access to Internet again. Although the integrity of this data cannot be specifically verified, studies have shown that paper and electronic diaries yielded data that were comparable in compliance rates, psychometric properties, and pattern of findings (Green, Rafaeli, Bolger, Shrout, & Reis, 2006). Coupled with the low rate of invalid data (less than 6%) for the electronic diaries, we elected to include diaries completed electronically or by paper in our analyses, resulting in 864 valid sexual events reported by 132 participants (66 couples). Each participant received \$20 for completing the orientation session and \$12 per week for the diaries (\$116 total). University and health centers' institutional review boards approved the present study.

Daily Diary Measures

Partner responses. 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; Kerns, Turk, & Rudy, 1985), and the partner version of this scale (Sharp & Nicholas, 2000). These scales assess perceived 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 for women with PVD (Rosen et al., 2010) and confirmatory factor analysis (CFA) indicated that our adapted items maintained the structure of the original measures. Participants indicated the frequency of male partner responses on a scale ranging from 1 (*never*) to 6 (*very frequently*). Higher scores indicate greater frequency of partner responses. Scores could range from 6 to 36 on the solici-

tous and 4 to 24 on the negative subscales. Within-person reliability, calculated across days using Omega, the most recent technique for estimating reliability in multilevel models (Geldhof, Preacher, & Zyphur, in press) was 0.73 and 0.72 for women and 0.85 and 0.85 for partners, for the solicitous and negative subscales, respectively. Perceived *facilitative* responses were assessed with the facilitative subscale of the Spouse Response Inventory (SRI), which has shown good validity and reliability (Schwartz, Jensen, & Romano, 2005). This scale was adapted to the current population of women with PVD (6 items; e.g., “tells me that I am pleasuring him”); (Rosen et al., 2012). CFA indicated that the items maintained the structure of the original measure. Participants indicated facilitative male partner responses on a scale ranging from 1 (*never*) to 6 (*very frequently*). Higher scores indicate a greater frequency of partner responses. Scores could range from 6 to 36. Omega for women and partners was 0.86 and 0.91.

Sexual function. Women's sexual function was assessed with the Monash Women's Health Program Female Sexual Satisfaction Questionnaire (MFSSQ; Davison et al., 2008). The MFSSQ assesses the nature and quality of a recent (within 24 hours) sexual experience. The MFSSQ includes 11 items as follows: two yes/no items about partner involvement and intercourse that provide information but do not contribute to the overall score, two yes/no items about initiation of sexual activity and orgasm, five items (sexual receptivity, ease of arousal, vaginal lubrication, degree of pleasure, and satisfaction) ranked from 1 to 9 whereby 1 for each item represents the lowest possible score, one item—ease of orgasm—scored from 0 to 9 where 0 represents a “no” to the occurrence of orgasm, and the 1 to 9 represents similar ranking as the previously described items. The MFSSQ has demonstrated good interitem reliability, test-retest reliability, and discriminant as well as convergent validity (Davison et al., 2008). The MFSSQ was adapted to assess male partners' sexual function because there is no validated and equivalent partner version. Only the two sexual arousal items required adaptation and were replaced with items assessing ease of obtaining and quality (i.e., “hardness”) of the erection. The ease of arousal/erection item was dropped because of experimenter error. A second arousal item (vaginal lubrication/quality of erection) ensured that the measure still assessed all aspects of sexual function. The potential range in scores for both women and men was 4 to 45, and higher scores reflected better functioning. Omega for women was 0.82 and for men was 0.71.

Results

Data Analysis

Women's perceived partner responses refer to the perception of her male partners' responses to her pain during intercourse, whereas men's partner responses refer to his perception of his own responses to women's pain during intercourse. Drawing on the Actor-Partner Interdependence model (APIM) (Kenny, Kashy, & Cook, 2006), a multivariate multilevel modeling approach was adopted in order to address the nonindependence in the data. This approach treats the three levels of dyadic diary data as two levels in which the lower level (i.e., within-person) is composed of both partners' daily reports, and daily reports from each partner are considered as repeated measures of the couple, representing the upper level (i.e., between-person) of the analysis (Kenny et al.,

2006). The degree of shared variance that exists among the residuals of both partners' outcomes can be estimated concurrently in APIM. The model was constructed to examine the influences of person's perception of male partner responses (i.e., actor effect) and partner's perception of male partner responses (i.e., partner effect) on the person's sexual functioning, separately for women and men. More specifically, a woman's sexual functioning was predicted both by the woman's perception of male partner responses and her partner's report of his own responses. Similarly, the effects of woman's perception of male partner responses and men's report of his own responses on men's sexual functioning were explored. Gender differences in each of the effects were tested.

The predictor variables varied both within-person and between-person. To permit the separation of the within-person effects from those operating on the between-person level, all independent continuous variables were centered around each person's mean, and these means were entered as between-person predictors. These centered scores represent the deviations of a person's daily perception of male partner responses from the person's generalized perception of male partner responses. For person-level predictors, group-mean centering was applied; the centered scores represent the person's relative standing within the sample on the person-level scores. Only findings for the covariation of daily scores are reported and discussed as this covariation represents a more nuanced test of the effects of male partner responses on sexual functioning, which is the focus of the present study. The random component was modeled using gender-specific random intercepts for person-level residuals and a heterogeneous first-order autoregressive covariance for the level-one residuals. Analyses were conducted using SAS version 9.2 PROC MIXED (SAS Institute Inc., 2009).

Descriptive Statistics

Women who were included in the analyses were no different from those who were excluded in average pain intensity during intercourse, age, relationship status, and household income. Included women were less educated, $b = -2.08$, $t(76) = -2.58$, $p = .01$, and had been experiencing pain for a shorter period, $b = -3.23$, $t(76) = 2.29$, $p = .03$, compared with 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. There were no significant main effects of descriptive variables on sexual functioning. Women ($M = 27.88$, $SD = 7.07$) reported poorer sexual functioning than men ($M = 38.49$, $SD = 3.94$) across all intercourse days, $t(429) = 12.08$, $p < .0001$.

Pearson-product correlations indicated that perceived solicitous and facilitative male partner responses were positively correlated within-person for women ($r = 0.26$) and men ($r = .28$), $p < .01$ for both. Perceived solicitous and negative male partner responses were also positively correlated within-person for women ($r = 0.16$, $p < .01$) and men ($r = 0.25$, $p < .001$). Finally, women and men's perceived solicitous male partner responses were moderately correlated ($r = 0.48$, $p < .001$), negative male partner responses were correlated at low levels ($r = .17$, $p < .01$), facilitative male partner responses were low-moderately correlated ($r = .36$, $p < .01$), and sexual functioning was moderately corre-

Table 1
Descriptive Statistics for the Sample ($n = 66$ Couples)

Characteristic	<i>M</i> (range) or <i>n</i>	<i>SD</i>	%
Characteristic			
Age (years)			
Women ($n = 65$)	27.91 (18–44)	5.94	—
Men	30.00 (19–55)	8.33	—
Women's pain intensity	4.93 (1–10)	1.89	—
Women's duration of pain (months; $n = 65$)	68.60 (6–228)	51.37	—
Education level (years)			
Women	15.80 (11–22)	2.59	—
Men	15.44 (12–24)	2.57	—
Marital status			
Married	28		42
Relationship length in years	5.67 (0–25)	5.32	—
Couple's annual income			
\$0–19,999	6	—	9
\$20,000–39,000	13	—	20
\$40,000–59,000	11	—	17
\$60,000 and over	36	—	55
Religion			
Women			
Catholic	18	—	27
Other	34	—	52
No religion	14	—	21
Men			
Catholic	16	—	24
Other	34	—	56
No religion	16	—	24
Independent variables			
Solicitous			
Women	14.08 (6.00–29.00)	5.07	—
Men	14.38 (6.00–25.00)	4.97	—
Facilitative			
Women	28.45 (10.21–36)	6.46	—
Men	27.06 (10.07–36)	6.97	—
Negative			
Women	4.47 (4.00–7.13)	0.57	—
Men	4.20 (4.00–6.89)	0.47	—
Dependent variable			
Sexual function (MFSSQ)			
Women	27.88 (15.23–48.50)	7.07	—
Men	38.49 (28.00–51.00)	3.94	—

Note. Analyses based on 864 (frequency of intercourse: $M = 6.54$; $SD = 4.99$; Range = 1–28) observations from 132 participants.

lated ($r = 0.46$, $p < .001$). Interclass correlations (ICC) indicate the shared variance between each partner's scores relative to the total variance across all partners (from all couples). ICCs were calculated as follows: solicitous (0.55 for women, 0.60 for men), negative (0.14 for women, 0.44 for men), facilitative (0.66 for women, 0.63 for men), and sexual functioning (0.55 for women, 0.49 for men).

Within-Person Effects of Male Partner Responses on Sexual Functioning

Women's sexual functioning. Several main effects emerged for perceived partner responses on women's sexual functioning that were consistent with the hypotheses (see Table 2). First, a main effect of woman's perceived male solicitous responses (i.e., actor effect) on woman's sexual functioning was found such that her sexual functioning was poorer on days of sexual interaction

Table 2
Within-Person Effects of Partner Responses on Sexual Functioning

Effects	<i>b</i> ^a (<i>SE</i>)	<i>df</i>	<i>F</i>	<i>p</i>	95% CL Lower–Upper	<i>r</i> ^b
Intercept	33.40 (.61)	430	2679.1	<.001	32.21–34.60	.93
Gender	–5.28 (.44)	413	111.36	<.001	–6.15––4.41	.46
Actor_Solicitous	–.10 (.05)	413	4.64	<.03	–.19–.01	.11
Partner_Solicitous	–.25 (.05)	413	25.63	<.001	–.35–.15	.24
Gender × Actor_Solicitous	.08 (.05)	413	2.30	.13	–.02–.18	.07
Gender × Partner_Solicitous	–.18 (.06)	413	10.72	<.01	–.29–.07	.10
Actor_Facilitative	.18 (.04)	413	18.15	<.001	.09–.26	.21
Partner_Facilitative	.03 (.04)	413	.72	.31	–.04–.11	.04
Gender × Actor_Facilitative	.13 (.04)	413	8.91	<.01	.05–.22	.15
Gender × Partner_Facilitative	–.03 (.04)	413	.36	.55	–.11–.06	.03
Actor_negative	–.90 (.23)	421	15.82	<.001	–1.34–.45	.19
Partner_negative	.01 (.31)	421	.00	.97	–.61–.63	.00
Gender × Actor_negative	.18 (.24)	421	.60	.44	–.28–.64	.04
Gender × Partner_negative	.13 (.32)	421	.16	.69	–.50–.76	.02

Note. Analyses were based on 864 observations (sexual events) from 132 participants.

^a Unstandardized regression coefficients. ^b Effect sizes were computed using the procedure recommended by Rosenthal and Rosnow (1984), using the formula: $r = \text{square root of } (F/F + df)$.

when she perceived greater solicitous responses from her male partner, $b = -.10$, $t(413) = 4.64$, $p < .05$. Second, a main effect of partner's perceived solicitous responses (i.e., partner effect) emerged: women's sexual functioning was poorer on days of sexual interaction when her male partner reported greater solicitous responses, $b = -.43$, $t(412) = -4.77$, $p < .001$. Third, an actor effect for perceived facilitative male responses on sexual functioning emerged for women: women reported improved sexual functioning on days when they perceived greater facilitative responses from their male partner, $b = .31$, $t(412) = 4.14$, $p < .001$. Finally, an actor effect of perceived negative responses on women's sexual functioning was found: women's sexual functioning worsened on days of sexual interaction when she perceived greater negative responses from her male partner, $b = -.90$, $t(421) = 15.82$, $p < .05$. The effects of partner's own report of facilitative and negative responses on women's sexual functioning were not significant.

Men's sexual functioning. Consistent with our exploratory hypotheses, a main effect of men's own solicitous responses (i.e., actor effect) on his own sexual functioning was found such that his sexual functioning worsened on days of sexual interaction when he reported greater solicitous responses, $b = -.10$, $t(413) = 4.64$, $p < .05$. An actor effect of perceived negative responses on men's sexual functioning was also found. Specifically, men's sexual functioning was poorer on days of sexual interaction when he reported greater negative responses, $b = -.90$, $t(421) = 15.82$, $p < .05$. The actor effect of facilitative responses and the effects of women's perceived responses (i.e., partner effects) on men's sexual functioning were not significant.

Discussion

This study investigated the daily associations between facilitative, solicitous, and negative male partner responses and sexual function in vulvodynia couples. To our knowledge, this study was the first to examine the within-person influence of partner responses in chronic pain and specifically, the associations between male partner responses and sexual functioning—the primary mea-

sure of impairment in vulvodynia—in the daily lives of couples with this condition. Controlling for partner responses reported by men on that day, a woman's sexual functioning improved on days when she reported greater facilitative and lower solicitous and negative male partner responses, and on days when her male partner reported lower solicitous responses. Controlling for partner responses as perceived by women, a man's sexual functioning worsened when he reported greater solicitous and negative responses. Results are consistent with operant learning models, demonstrating that partner responses—perceived by both women and partners—can reinforce and maintain a person's pain-related impairment. Results also support a recent growing body of evidence indicating strong associations between daily relationship factors and the health of both partners (Diamond et al., 2011).

The finding that women reported poorer sexual functioning on days where they perceived higher solicitous male partner responses and on days where men reported higher solicitous responses is consistent with prior single occasion studies of the association between solicitousness and disability in chronic pain (Leonard et al., 2006) and adds novel within-person and dyadic data to the literature. In line with operant theory and the CCM, greater solicitousness may reinforce pain behaviors as well as negative cognitive-affective appraisals such as catastrophizing, which are known to increase impairment, thereby increasing the likelihood that such patterns will be maintained (Leeuw et al., 2007). In vulvodynia, solicitousness may encourage passivity and avoidance of both penetrative and nonpenetrative sexual activity, in turn decreasing all aspects of sexual functioning. Women with vulvodynia are typically avoidant of sexual activities in order to reduce the pain. This extensive avoidance becomes a reinforcing consequence over the long term, and can maintain the pain and associated sexual difficulties. Avoidance of all sexual activities may have wider reaching implications for the couple by negatively affecting other aspects of their relationship such as intimacy and closeness. With regard to the partner effect, male partner's own solicitousness has been shown to contribute to his own heightened catastrophizing about intercourse pain (Rosen, Bergeron, Steban,

& Lambert, 2013). A catastrophizing partner may be more inhibited during sexual activities, contributing to a suboptimal sexual interaction or to greater avoidance of all sexual activities, and diminishing sexual desire and arousal for both members of the couple.

Women's sexual functioning also worsened on days when she reported greater negative male partner responses. Prior findings from retrospective studies have been mixed with respect to the association between negative partner responses and disability in chronic pain (Leonard et al., 2006). Negative partner responses may increase avoidance, which in turn may enhance negative cognitive appraisals of the pain, one's ability to cope with the pain, and negative affect, ultimately leading to greater impairment. Negative responses may also be viewed as stressful in their own right, leading to greater anxiety. In PVD, heightened anxiety leads to greater pelvic floor hypertonicity and decreases arousal, adversely affecting women's overall sexual function (Payne et al., 2007). Taken together, and consistent with operant and communal coping models, it is possible that male partner responses that are perceived to be supportive (e.g., solicitous) or negative can reinforce maladaptive pain behaviors and cognitions by focusing attention toward the pain, particularly if other sources of attention (i.e., pleasure) are absent (Schwartz et al., 2005). When attention is directed toward the pain, a woman and her partner are less able to focus on the pleasurable rewards of the sexual activity, thus interfering with any existing sexual desire and arousal, and leading to poorer overall sexual functioning for both.

In contrast, facilitative partner responses direct attention toward sexual rewards and encourage adaptive, approach-oriented coping, thereby negatively reinforcing pain behaviors and cognitions such as avoidance and catastrophizing, and enhancing sexual functioning. The current study found that a woman's sexual functioning improved on days when she reported greater facilitative male partner responses, which is consistent with cross-sectional studies in other chronic pain populations (Raichle et al., 2011). Facilitative responses may promote incorporating less painful or nonpainful sexual behaviors, leading to improved overall sexual function. These responses may also foster greater feelings of closeness and intimacy in the relationship, factors which are known to enhance overall sexual functioning and sexual satisfaction (Althof et al., 2005). Finally, facilitative responses may decrease women's level of anxiety, reducing pelvic floor hypertonicity and enhancing sexual arousal.

The current results stand in contrast to the single prior vulvodynia study examining male partner responses and sexual function, which did not find any significant associations (Rosen et al., 2010). Partner responses and functional impairments are likely to vary across interpersonal interactions. Indeed, several studies with other chronic pain populations have demonstrated daily fluctuations in physical disability and psychosocial adjustment (Holtzman & DeLongis, 2007; Kratz, Davis, & Zautra, 2011). Other studies have shown daily changes in aspects of sexual functioning, such as sexual desire (Impett, Strachman, Finkel, & Gable, 2008). The use of daily experience methods may have better captured the complexities of interpersonal interactions and of sexual functioning in vulvodynia, across time, and in a more natural context.

Exploratory corresponding effects of male partner responses on male partners' sexual functioning indicated that controlling for male partner responses as perceived by women, a man's sexual

functioning was poorer when he reported greater solicitous and negative responses. The proposed mechanisms, accounting for the associations between male partner responses and women's sexual functioning could all conceivably contribute to men's poorer functioning. The impact of vulvodynia on male partners should not be ignored; especially in light of research with couples dealing with other sexual dysfunctions. For example, there is evidence that erectile dysfunction has a significant adverse effect on the female partners' sexual function (Fisher, Rosen, Eardley, Sand, & Goldstein, 2005). Further, as indicated by the moderate to low within-person correlations, a lack of agreement in women and partners' reports of male partner responses highlights the fact that researchers must carefully consider the purpose of their research questions and proposed findings when choosing the respondent. For example, interventions designed to modify partner responses should include both the patient's perception of responses as well as the partner's report of his or her own responses to ensure an accurate account of each person's perspective (Pence, Cano, Thorn, & Ward, 2006).

Strengths and Limitations

This daily experience study has several notable strengths. The interpersonal approach of including both members of the couple is relatively rare in vulvodynia, despite widespread appreciation of the social context of pain as well as the clearly interpersonal nature of sexual interactions and of this condition in particular. In addition, use of daily experience methods allowed us to obtain independent reports from both partners close in time to the sexual interactions, and thus to test a model examining the unique effects of each partners' report of male partner responses on sexual functioning. Finally, this study was the first to use a validated, self-administered questionnaire of female sexual functioning in a daily experience study, thereby correcting methodological and theoretical limitations in female sexual function research in general, and more specifically in partner responses and sexual function in vulvodynia.

It is also important to note some limitations of this study. First, the sample consisted of heterosexual cohabiting couples, and the included women were less educated and experienced pain for a shorter duration of time compared with excluded women, limiting the generalizability of the findings and potentially affecting the results. Second, the data were based on daily self-report measures and are subject to the usual criticisms of self-report such as social desirability biases. Third, the data and analyses were correlational, and causal conclusions cannot be drawn. Nonetheless, support for our theoretically based hypotheses provides a solid foundation for interpreting the findings. Finally, some of the daily effects of partner responses could be considered small. However, Abelson (1985) discouraged researchers from discounting small variance effects when such effects are significantly different from zero, are relevant in the daily lives of individuals living with chronic pain, and may lead to more substantial cumulative effects over time. In line with operant principles, it is plausible that the effects of partner responses on couples' ability to manage their painful sexual relations would grow over repeated interactions. Replication of the current findings with other chronic pain populations will help determine the magnitude of the daily associations between partner responses and disability.

Conclusions

The current findings suggest that facilitative partner responses may improve sexual functioning whereas solicitous and negative responses may be detrimental in the everyday sexual lives of women with vulvodynia and their partners. Theoretically, and consistent with biopsychosocial models and the CCM, the results showcase the importance of moving beyond strictly intraindividual conceptualizations of chronic pain to further our understanding of the interpersonal dimensions of pain (Keefe & Porter, 2007). Recent calls support the need for corresponding research to support novel theoretical models that incorporate the social context of pain (Cano & Williams, 2010). The results also have important implications for improving psychological treatments of a prevalent chronic pain condition—vulvodynia—by elucidating the influence of partner responses to women's pain on sexual functioning. Including the partner in treatment for other sexual dysfunctions and in other chronic health conditions has yielded positive outcomes (Manne, Ostroff, & Winkel, 2007), indicating that such studies would be an important avenue for future research. Couple interventions could use cognitive-behavioral strategies to assist couples in increasing facilitative and decreasing negative and solicitous responses, thus reducing their negative impact on sexual functioning. Targeting relationship factors such as partner responses may enhance the quality and efficacy of interventions aimed at improving the sexual functioning of women with vulvodynia and their partners.

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