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**Expression of pain behaviors and perceived partner responses in individuals with chronic pain: The mediating role of partner burden and relationship quality**

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16

1 **Abstract**

2 **Objective.** Expressions of pain by individuals with chronic pain may encourage solicitous and  
3 distracting responses from some partners and punishing responses from others. Partners’  
4 responses can impact the wellbeing of individuals with chronic pain. Yet information about  
5 factors that can explain the link between expression of pain behaviors and different partners’  
6 responses is scarce. The objective of this study was to investigate the role of perceived partner  
7 burden and relationship quality in the link between expressions of pain behaviors and perceived  
8 partner responses (i.e., solicitous, distracting, and punishing responses).

9 **Methods.** Participants were 158 individuals with chronic pain (i.e., experiencing pain on most  
10 days for at least six months prior to participating in the study) who completed questionnaires  
11 about pain behaviors, as well as perceptions of partner burden, relationship quality, and partners’  
12 solicitous, distracting, and punishing responses. The link between expressing pain and each type  
13 of partner response was investigated by serial mediation analysis. Partner burden and  
14 relationship quality were entered into all analyses as the first and the second mediator,  
15 respectively.

16 **Results.** Expressing more pain was related to higher levels of perceived partner burden, which in  
17 turn, was associated with poorer relationship quality. Poorer relationship quality was associated  
18 with reporting fewer solicitous and distracting partner responses and more punishing responses.

19 **Discussion.** Enhanced partner burden and reduced relationship quality may be one pathway  
20 through which pain behaviors relate to partner responses.

21 **Keywords:** chronic pain, partner responses, burden, relationship quality

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## Introduction

Pain behaviors are essential for estimating pain and necessary support by observers. From the perspective of the social communication model of pain, pain is a subjective experience; however, pain manifestations and pain-related behaviors such as verbal communications, facial expressions, body gestures, and even paralinguistic cues (e.g., moaning) can inform the observers (e.g., spouses and romantic partners) of the pain experience.<sup>1</sup> These pain behaviors and expressions are adapted to encourage others, especially, family caregivers and partners to provide care and support for the person in pain.<sup>1,2</sup> Partner responses to that pain may include (among others), solicitousness (e.g., taking over chores and responsibilities), distraction (e.g., encouraging the patient to work on a hobby), and punishing responses (e.g., expressing anger and frustration).<sup>3,4</sup> Several studies have shown that partners' responses play an essential role in the well-being of individuals with chronic pain (e.g.,<sup>5-7</sup>). Specifically, some studies have shown that individuals with chronic pain report higher levels of pain intensity, disability, and more functional problems when their partners express more solicitous responses.<sup>4,8,9</sup> Distraction and distracting responses have been shown to be related to lower levels of pain intensity and distress during painful procedures in some research (e.g.,<sup>10,11</sup>). Finally, findings of some research on partners' punishing responses have indicated that punishing responses are related to higher levels of pain intensity and depression in individuals with chronic pain.<sup>12,13</sup> While there are still inconsistencies in the literature regarding the impacts of these responses on the patients' outcomes and the above-mentioned findings have not been observed uniformly (e.g.,<sup>14</sup>) or they have been observed in opposite directions (e.g.,<sup>15,16</sup>); in general, partners' responses have been found to play a vital role in the well-being of individuals with chronic pain.<sup>17</sup> Therefore, it is essential to understand factors that explain the link between the expression of pain behaviors and

1 patients' perceptions of different types of partners' responses. Investigating these factors may  
2 help researchers and clinicians better understand the mechanisms that impact patients'  
3 perceptions of their partner responses to the pain, which may inform targets of intervention in  
4 pain management programs.

5 Partners of individuals with chronic pain may rely on the expression of pain behaviors as  
6 indicators that the person with pain needs help. To provide support, partners may make  
7 significant changes in their lives, such as reducing their social and professional activities.<sup>18,19</sup>  
8 These changes along with caregiving tasks and responsibilities (e.g., helping with dressing,  
9 walking stairs, providing emotional and motivational support) or even observing a loved one's  
10 pain, may contribute to partners' burden. Partner burden often manifests itself as lower levels of  
11 physical and psychological well-being, loss of control over life, and higher levels of anger and  
12 distress in partners.<sup>20-23</sup> Consequently, individuals with chronic pain who express more pain  
13 behaviors—intentionally or unintentionally—may be more likely to perceive higher levels of  
14 burden for their partners.

15 Partners' burden is negatively associated with the perceived relationship quality between  
16 individuals with chronic pain and their partners.<sup>24</sup> Based on social exchange theory,<sup>25</sup> in any  
17 given relationship, individuals strive to reduce the costs and maximize the benefits of the  
18 relationship; otherwise, dissatisfaction with the relationship will arise.<sup>26</sup> When individuals with  
19 chronic pain perceive burden in their partners (e.g., they feel their partner is angry or have  
20 restricted their activities because of the pain), it might interfere with focusing on the positive  
21 aspects of their relationship and they may be more likely to perceive their partners as dissatisfied  
22 with the relationship. These perceptions may result in a negative way of interpreting partner  
23 responses, an increased expression of negative affect, and an increased dissatisfaction between

1 individual with chronic pain and their partner.<sup>24,27</sup> Therefore, in the couple context, when one  
2 member is suffering from a disabling chronic pain and they also perceive their partner as  
3 suffering from feelings of burden, the room for engaging in positive activities and expressing  
4 positive affections may become more limited, as reflected by lower relationship quality between  
5 individuals with chronic pain and their partners.

6         The relationship quality between individuals with chronic pain and their partners plays an  
7 essential role in how they perceive their partners' responses.<sup>28,29</sup> For example, when individuals  
8 with chronic pain are less satisfied with their relationship, they tend to perceive their partners'  
9 responses as more punishing and unsupportive, compared to those who are more satisfied.<sup>28,29</sup> In  
10 a sample of individuals with chronic pain, Campbell and colleagues<sup>30</sup> found that those with  
11 chronic pain who reported greater relationship quality with their partners also reported more  
12 solicitous and fewer punishing responses from their partners. In addition, based on the social  
13 support model,<sup>31</sup> when individuals with chronic pain have a better relationship quality with their  
14 partners, they perceive partners' responses to be less punishing and more solicitous.<sup>28</sup> The  
15 association between relationship quality and distracting responses in individuals with chronic  
16 pain has received less attention so far (e.g.,<sup>30</sup>). Both solicitous and distracting responses are  
17 typically considered as "helpful" responses by individuals with chronic pain.<sup>32</sup> Therefore,  
18 individuals with chronic pain who report better relationship quality may be more likely to report  
19 more solicitous and distracting responses and less punishing responses than individuals with  
20 chronic pain with poorer relationship quality. It should be noted that although viewed as  
21 supportive by individuals with chronic pain, solicitous partners' responses have actually been  
22 linked to more disability and pain.<sup>33</sup> However, these responses along with distracting responses

1 might still be the preferred responses of individuals with chronic pain because they communicate  
2 partners' empathy and concern.

3 The current study investigated the role of perceived partner burden and relationship  
4 quality in the link between pain behaviors and perceived partner responses. It was hypothesized  
5 that expressing more pain behaviors by individuals with chronic pain would be associated with  
6 greater perceived burden on their partners, which, in turn would be related to poorer self-reported  
7 relationship quality. Finally, poorer relationship quality would be associated with reporting fewer  
8 solicitous and distracting, and more punishing partner responses.

## 9 **Materials and Methods**

### 10 **Procedure and Participants**

11 The data for this cross-sectional study were collected over a 6-month period.  
12 Advertisements promoting this study were shared online using social media platforms (i.e.,  
13 Twitter and Facebook) and by asking pain-related organizations, patient advocates, and  
14 individuals with chronic pain to share the study with their online followers and members of their  
15 pain-related groups. Individuals who were interested in participating were asked to click on a  
16 link which directed them to an introductory page on our laboratory website that provided more  
17 information pertaining to the study as well as its inclusion and exclusion criteria. Inclusion  
18 criteria were 1) being at least 18 years of age; 2) experiencing pain on most days for the prior six  
19 months; 3) experiencing pain that was not caused by a terminal illness, such as cancer; 4) being  
20 involved in a current romantic relationship for at least six months; 5) living with a romantic  
21 partner; 6) being a resident of Canada or the United States; and 7) being able to read and  
22 understand English. Interested individuals were invited to click on a link that directed them to

1 another page in which they answered eligibility questions. (Except for the introductory page, the  
2 rest of the pages and the main survey were hosted on Qualtrics.com). Those who were not  
3 eligible were directed to another page on which they were thanked for their interest in the study  
4 and it was explained to them that they were not eligible. Conversely, eligible individuals were  
5 directed to an informed consent form and were asked to read the form and indicate their consent  
6 by clicking on “I agree”. In total, 315 individuals answered the eligibility questions. Of those, 38  
7 were not eligible for the following reasons: not living with a romantic partner ( $n = 26$ ), not being  
8 a resident in either Canada or the United States ( $n = 7$ ), having a terminal illness ( $n = 6$ ), not  
9 being involved in a romantic relationship ( $n = 5$ ); and not being able to read and understand  
10 English ( $n = 1$ ). Of those who were eligible ( $n = 276$ ), 225 individuals provided their consent and  
11 started the survey. The data of 55 participants were removed because they had completed less  
12 than 20% of the survey. In addition, the data of 12 participants were removed because they had  
13 answered incorrectly to more than one (out of a possible three) attention check items. Each  
14 attention check item (embedded throughout the survey) asked participants to select a specific  
15 response. For example, the attention check item that was embedded among the items of the  
16 Revised Dyadic Adjustment Scale was “This is an attention check, please select 0 (All of the  
17 time)”. Participants responded to an online survey assessing their pain behaviors, perceived  
18 partner burden, relationship quality, and perceived partner responses to their pain. Participants  
19 who completed the study were entered into a prize draw for one of three \$50 (Canadian) e-gift  
20 cards. This research was approved by our institution’s Research Ethics Board (REB #: 2016-  
21 3935).

## 22 **Measures**

1           *Demographic variables.* A demographics questionnaire was used to collect information  
2 on participants' age, sex, country of residence, marital status, ethnicity, pain condition and  
3 duration.

4           *Pain behaviors.* To assess pain behaviors, participants completed the Pain Behaviour  
5 Check List (PBCL;<sup>34</sup>). This measure included the instruction "How often do you do each of the  
6 following?" followed by 17 items describing four domains of pain behaviors. These four  
7 domains included distorted ambulation (e.g., walk with a limp), affective distress (e.g., express  
8 anger), facial/audible expressions (e.g., clench teeth), and seeking help (e.g., talk about the pain).  
9 Items were scored on a 7-point scale with endpoints of 0 (never) and 6 (very often). Responses  
10 were averaged and could range from 0 to 6, with higher scores reflecting greater pain behaviors.  
11 This measure demonstrated good reliability and validity in prior studies of chronic pain.<sup>34</sup> The  
12 Cronbach's alpha for the total score of the PBCL in the current study was .89.

13           *Perceived partner burden.* To assess participant perceptions of partner burden, they  
14 completed the Zarit Burden Interview (ZBI;<sup>23</sup>). The Zarit Burden Interview was originally  
15 developed to study the burden among different caregivers' population (e.g.,<sup>18,35</sup>). In previous  
16 studies, this measure has been administered both as an interview (e.g.,<sup>36</sup>) and as a questionnaire  
17 (e.g.,<sup>35</sup>). To assess participant *perception* of partner burden, the wording of some items was  
18 slightly adapted (e.g., "Do you feel that your social life has suffered because you are caring for  
19 your relative?" was changed to "Do you feel that your romantic partner's social life has suffered  
20 because s(he) is caring for you?"). For each question (e.g., "Do you feel, your romantic partner is  
21 angry when s(he) is around you?" or "Do you feel that because of the time your romantic partner  
22 spends with you, your romantic partner has not enough time for her/himself?"), participants were  
23 asked to respond on a 4-point Likert scale ranging from 0 (never) to 4 (nearly always). The total

1 score of the Zarit Burden Interview was averaged and could range from 0 to 4. Higher scores  
2 indicated more perceived burden in partners. The Cronbach's alpha for the ZBI in this study was  
3 .90.

4 *Relationship quality.* To assess relationship quality, participants completed the well-  
5 validated Revised-Dyadic Adjustment Scale.<sup>37</sup> This measure consisted of 14 items describing  
6 three domains of relationship quality; these domains included consensus (6 items), satisfaction (4  
7 items), and cohesion (4 items). Participants rated all items on a 6-point Likert scale with  
8 endpoints of 0 (always disagree; all of the time; never; never) and 5 (always agree; never; more  
9 often) or 4 (every day). An example item asked, "How often do you and your partner quarrel?"  
10 Responses were averaged and could range from 0 to 5, with higher scores indicating better  
11 relationship quality. This measure had acceptable internal consistency and construct validity in  
12 prior studies.<sup>37,38</sup> In the current study, the Cronbach's alpha was .87.

13 *Perceived partner responses.* To assess participant perceptions of their partners'  
14 responses to their pain, the "Significant Other Response" subscale of the West Haven-Yale  
15 Multidimensional Pain Inventory (WHYMPI)<sup>39</sup> was used. This section had 14 items and  
16 consisted of three subscales including solicitous responses (6 items; e.g., "gets me to rest"),  
17 distracting responses (4 items; e.g., "encourages me to work on a hobby"), and punishing  
18 responses (4 items; e.g., "ignores me"). Participants were asked to indicate how often (in  
19 general) their partner responded to their pain in that particular way on a Likert scale ranging  
20 from 0 (never) to 6 (very often). In the current study responses to each subscale were averaged  
21 and could range from 0 to 6, with higher scores indicating more solicitous, distracting, or  
22 punishing responses. Prior research indicates that the reliability and validity estimates for the  
23 solicitous, distracting, and punishing subscales in the West Haven-Yale Multidimensional Pain

1 Inventory were acceptable.<sup>39</sup> In the current study, the alphas for solicitous, distracting, and  
2 punishing subscales were .78, .68, and .90, respectively.

### 3 **Statistical analyses**

4 To investigate the associations among the variables in this study, Pearson product-  
5 moment correlations were conducted. Demographic variables that were significantly correlated >  
6 .30 with the study variables (i.e., the predictor, the mediators, or the dependent variables) were  
7 controlled for in the mediation analyses. As Figure 1 displays, in the conceptual model, the  
8 independent variable (i.e., pain behaviors) was related to each dependent variable (i.e., partner  
9 responses: solicitous, distracting, and punishing responses) through two mediators ( $M_1 =$   
10 perceived partner burden and  $M_2 =$  relationship quality), which were operating in serial. To test  
11 this model, model 6 of the SPSS PROCESS macro was used. Model 6 allowed for the  
12 investigation of conceptual models with two mediators in serial.<sup>40</sup> Three separate serial  
13 mediation analyses were used for each dependent variable (i.e., solicitous, distracting, punishing  
14 responses). As Tables 2-4 show, in each serial mediation analysis the total effect of the  
15 independent variable on the dependent variable is shown by weight  $c$  (total effect shows the  
16 association between the independent and the dependent variables). The direct effect of the  
17 dependent variable on the independent variable is shown by weight  $c'$ . The direct effect shows  
18 the extent to which the dependent variable varies when there is a one-unit increase in the  
19 independent variables and the mediators is kept constant. In addition, in the current study,  
20 because there were two mediators in the model, the output consisted of three indirect effects:  
21 Weight  $a_1b_1$  represents the indirect effect of the independent variable on the dependent variable  
22 solely through perceived partner burden (meaning that relationship quality was excluded; indirect  
23 effect 1;  $X \rightarrow M_1 \rightarrow Y$ ). Weight  $a_2b_2$  represents the indirect effect of the independent variable on

1 the dependent variable only through relationship quality (meaning that perceived partner burden  
2 was excluded; indirect effect 2;  $X \rightarrow M_2 \rightarrow Y$ ), and weight  $a_1d_2b_2$  represents the indirect effect of  
3 the independent variable on the dependent variable through both perceived partner burden and  
4 relationship quality (indirect effect 3;  $X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ ).

## 5 **Results**

### 6 **Descriptive characteristics**

7 The final sample of the current study consisted of 158 individuals with chronic pain. The  
8 mean age of the participants was 38.1 ( $SD = 9.42$ ) years. The majority of participants were  
9 women (88%;  $n = 139$ ). In addition, most participants were married (67.7%;  $n = 107$ ) and the  
10 rest were residing with their partner (29.1%;  $n = 46$ ). The average length of the relationship  
11 between participants and their partners was 9.6 ( $SD = 9.02$ ) years. The number of participants  
12 that were from the United States (51.3%;  $n = 81$ ) were only slightly more than the number of  
13 participants who were from Canada (48.7%;  $n = 77$ ). Participants identified as English Canadian  
14 (44.3%;  $n = 70$ ), American (44.3%;  $n = 70$ ), French Canadian (1.3%;  $n = 2$ ), First Nation  
15 Canadian (1.3%;  $n = 2$ ), and the rest were comprised of other ethnicities (6.9%;  $n = 11$ ). About  
16 one fifth of the participants (20.9%;  $n = 33$ ) indicated that they have no diagnosis for their  
17 chronic pain, 20.3% ( $n = 32$ ) indicated that they had only one diagnosis for their chronic pain,  
18 and the remaining participants (58.8%;  $n = 92$ ) reported more than one diagnosed pain condition.  
19 The most common pain condition among participants was migraine headache (45.6%;  $n = 72$ ).  
20 The other reported diagnosed pain conditions included tension headache (21.5%;  $n = 34$ ),  
21 irritable bowel syndrome (25.9%;  $n = 41$ ), chronic low back pain (36.7%;  $n = 58$ ), fibromyalgia  
22 (32.9%;  $n = 52$ ), musculoskeletal pain (31%;  $n = 49$ ), interstitial cystitis (1.9%;  $n = 3$ ),  
23 dyspareunia (8.2%;  $n = 13$ ), and endometriosis (11.4%;  $n = 18$ ). As participants could indicate

1 more than one pain diagnosis, these numbers represent the total number of pain diagnoses that  
2 were reported by patients and not the total number of patients. In addition, participants were  
3 asked to select the location(s) of their pain on a body map. They could select up to 10 locations.  
4 The main pain locations that were selected by the participants were feet and legs (93%;  $n = 147$ ),  
5 pelvic and gluteal (68%;  $n = 108$ ), neck (76%;  $n = 107$ ), shoulders (51%;  $n = 82$ ), head (54%;  $n =$   
6 94), lower back (47%;  $n = 75$ ), upper back (28%;  $n = 45$ ), hands (47%;  $n = 75$ ), abdomen (19%;  
7  $n = 31$ ), and thorax (.05%;  $n = 9$ ). The average pain duration was 9.42 years ( $SD = 8.73$ ).

8 Participants' sex was not associated with any of the main variables in the study. Age was  
9 negatively associated with reporting of partners' solicitous ( $r = -.23$ ;  $p < .01$ ) and distracting  
10 responses ( $r = -.27$ ;  $p < .01$ ). Furthermore, pain duration was only associated with expression of  
11 pain behaviors ( $r = -.20$ ;  $p < .01$ ). Country (residing in Canada vs. the United States) was  
12 positively related to partner burden ( $r = .25$ ;  $p < .01$ ; living in Canada was related to reporting  
13 less partner burden; mean of partner burden in Canada = 1.94, mean of partner burden in the  
14 United States = 2.35;  $t = -3.25$ ;  $p = .001$ ). Finally, country was also related to reporting more  
15 solicitous responses ( $r = .17$ ;  $p < .05$ ; residing in Canada was related to reporting less solicitous  
16 responses; mean of solicitous responses in Canada = 4.40, mean of solicitous responses in the  
17 United States = 4.85;  $t = -2.10$ ;  $p = .02$ ). Because none of the correlations between the  
18 demographic variables and the main variables in the model were higher than .30 we did not  
19 include any covariates in the analyses. Table 1 presents the associations between the study  
20 variables.

21 **Mediating effects of perceived partner burden and relationship quality in the associations**  
22 **between pain behaviors and perceived partner responses**

1            *Solicitous partner responses.* The results presented in Table 2 show that the total effect  
2 (weight  $c$ ) was not significant (coefficient = .16;  $p = .09$ ), whereas the direct effect (weight  $c'$ )  
3 was significant (coefficient = .24;  $p = .01$ ). The indirect effect 1 (pain behaviors → partner  
4 burden → solicitous responses) was significant (coefficient = .11; CI: .02–.23), meaning that  
5 partner burden mediated the link between the expression of pain behaviors and perceived  
6 solicitous partner responses. However, the indirect effect 2 (pain behaviors → relationship quality  
7 → solicitous responses) was not significant (coefficient = -.06; CI: -.18 –.04), suggesting that  
8 relationship quality alone did not mediate the link between pain behaviors and reporting  
9 solicitous responses. Finally, the indirect effect 3 (pain behaviors → partner burden →  
10 relationship quality → solicitous responses) was significant (coefficient = -.14; CI: -.23 – -.08)  
11 indicating that higher pain behaviors was related to higher levels of perceived partner burden,  
12 which in turn, was related to poorer relationship quality, and then to reporting less partner  
13 solicitous responses.

14            *Distracting partner responses.* Table 3 shows the results of the serial mediation analysis  
15 with distracting partner responses as the outcome. The total effect (weight  $c$ ; coefficient = .29;  $p$   
16 < .01) and the direct effect (weight  $c'$ ; coefficient = .38;  $p < .01$ ) were both significant. The  
17 indirect effect 1 (pain behaviors → partner burden → distracting responses; coefficient = .06; CI:  
18 -.01 – .16) and indirect effect 2 (pain behaviors → relationship quality → distracting responses;  
19 coefficient = -.04; CI: -.14 –.03) were not significant. Results showed that indirect effect 3 (pain  
20 behaviors → relationship quality → distracting responses) was significant (coefficient = -.11; CI:  
21 -.18 – -.06). This significant, indirect effect indicated that a greater expression of pain behaviors  
22 was related to higher levels of perceived partner burden. In turn, higher perceived partner burden

1 was related to lower relationship quality. Finally, lower relationship quality was related to  
2 reporting fewer partner distracting responses.

3 *Punishing partner responses.* The results of the serial mediation analysis with punishing  
4 partner responses as the outcome are presented in Table 4. The results indicate that the total  
5 effect was significant (weight  $c$ ; coefficient = .54;  $p < .01$ ), while the direct effect did not reach a  
6 significant level (weight  $c'$ ; coefficient = .13;  $p = .16$ ). The mediating effect of partner burden on  
7 the link between pain behaviors and reporting partner punishing responses was significant  
8 (indirect effect 1; coefficient = .14; CI: .04 – .26), indicating that partners' burden mediates the  
9 link between pain behaviors and partners' punishing responses. Similar to the findings of the  
10 previous analyses, relationship quality alone had no mediating effect on the association between  
11 pain behaviors and reporting punishing partner responses (coefficient = .07; CI: -.05 – .22).  
12 Finally, the indirect effect 3 (pain behaviors → partner burden → relationship quality →  
13 punishing responses) was also significant (coefficient = .18; CI: .11 – .28). This result specifies  
14 that higher levels of pain behaviors were associated with greater perceived partner burden. In  
15 turn, higher perceived partner burden was related to lower relationship quality, which was then  
16 associated with greater punishing partner responses.

## 17 **Discussion**

18 The current research examined two factors—perceived partner burden and relationship  
19 quality—that may explain the link between pain behaviors of individuals with chronic pain and  
20 their partners' responses to the pain. First, the results showed that when perceived partner burden  
21 was entered into the model as the only mediator, expressing more pain behaviors was related to  
22 higher perceived partner burden, which in turn, was related to reporting less solicitous and more

1 punishing responses. However, relationship quality alone did not have any mediating effect.  
2 Importantly, the results supported our main hypothesis that the indirect effects of perceived  
3 partner burden and relationship quality would *sequentially* explain the link between expression  
4 of pain behaviors by individuals with chronic pain and perceived partner responses to their pain.  
5 Specifically, expressing more pain behaviors was related to higher levels of perceived partner  
6 burden, which was associated with lower relationship quality. Lower relationship quality was, in  
7 turn, related to reporting fewer solicitous and distracting, and more punishing partner responses  
8 by individuals with chronic pain. Consistent with social exchange theory<sup>26</sup> and the social support  
9 model,<sup>31</sup> the findings highlight how perceived partner burden and relationship quality may be  
10 one pathway by which the pain behaviors of the individuals with chronic pain relate to  
11 perceptions of their partners' solicitous, distracting, and punishing responses.

12         The findings revealed an association between pain expressions of individuals with  
13 chronic pain and perceived partner burden, and, that greater perceived partner burden, was in  
14 turn, related to reporting less solicitous and more punishing responses. The association between  
15 greater pain behaviors and higher perceived partner burden is in line with findings in other  
16 caregiver studies (e.g.,<sup>41,42</sup>). Partners who are dealing with caregiving responsibilities may have  
17 to adjust their lives because of the support that their partners in pain needs. At times, this  
18 adjustment may mean that they sacrifice their own personal and professional goals to be able to  
19 provide support to individuals with chronic pain. When individuals with chronic pain express  
20 more pain behaviors, these behaviors may encourage their partners to stop their current activities  
21 and shift their attention to the pain. Therefore, individuals with chronic pain who express higher  
22 levels of pain behaviors may perceive more interruptions in their partners' personal, social, and  
23 professional goals, which are associated with experiencing higher levels of burden in their

1 partners.<sup>41,43</sup> Thus, those with chronic pain may know—based on their own experiences or the  
2 feedback that they receive from their partners—that seeing them suffer from pain can be  
3 burdensome for their partners, especially when partners’ efforts in reducing pain are not  
4 successful.<sup>44</sup> In addition, individuals with pain can observe the various tasks and caregiving  
5 responsibilities (e.g., doing grocery shopping, taking them to their medical appointment, and  
6 doing household chores) that their partners perform daily. These activities and tasks which are  
7 labeled by previous research as objective burden (e.g.,<sup>45</sup>) can provide an estimation for  
8 individuals with pain regarding the burden that their partners may experience. Furthermore,  
9 individuals with chronic pain may perceive other manifestations of burden in their partners  
10 including anger, strain and psychological distress. In turn, perceiving that their partners are angry  
11 or strained when they are around them, individuals with pain may be more likely to label their  
12 partners’ responses as less solicitous and more punishing.

13         Furthermore, findings showed that expressing more pain behaviors was associated with  
14 perceived partner responses to their pain via a serial mediational path that consisted of both  
15 perceived partner burden and relationship quality. Perceiving a higher level of burden in partners  
16 (e.g., higher levels of anger and strain, lower levels of psychological well-being) may reduce the  
17 opportunities or the inclinations for shared positive exchanges and activities between individuals  
18 with chronic pain and their partners.<sup>46</sup> According to social exchange theory<sup>26</sup>, perceiving higher  
19 burden in partners may reinforce the belief that partners are benefiting less from their  
20 relationship with their partner in pain and that there are more costs to their relationship, resulting  
21 in a lower relationship quality. Another possibility is that individuals with chronic pain feel  
22 guilty and anxious because they believe that their pain causes many difficulties for their partners,  
23 and these negative cognitions and emotions interfere with their overall evaluation of the

1 relationship, regardless of partners' actual experience of burden. While the current study  
2 investigated partner burden based on the perceptions of the individuals with chronic pain, such  
3 perceptions are likely to be influenced by the actual burden level and behaviors that are  
4 expressed by their partners.

5         Finally, findings showed that lower relationship quality was associated with individuals  
6 with chronic pain reporting fewer solicitous and distracting responses and more punishing  
7 partner responses. When individuals with chronic pain are less satisfied in their relationship, they  
8 are more likely to label their partners' responses as negative or they are prone to ignore their  
9 partners' solicitous or distracting responses, compared to when they are more satisfied in their  
10 relationships.<sup>28</sup> In addition, lower relationship quality may discourage partners from showing  
11 more solicitous or distracting responses and increase their punishing responses such as showing  
12 anger and frustration.

13         One important issue that should be addressed here is that higher relationship quality was  
14 linked to perceiving more partner solicitous responses. Partner solicitous responses convey  
15 partners' care and sympathy to individuals with chronic pain, and these responses might be the  
16 preferred responses of individuals with chronic pain. However, because these responses reinforce  
17 the avoidance of pain as well as negative cognitions such as pain catastrophizing, they have been  
18 found to be related to higher levels of pain intensity and pain-related disability in individuals  
19 with chronic pain.<sup>47,48</sup> Therefore, solicitous responses are considered to be associated with both  
20 positive (e.g., better relationship quality) and negative (e.g., higher disability levels) outcomes.  
21 As suggested by previous studies (e.g.,<sup>49</sup>), one solution that may contribute to maintaining high  
22 relationship quality but avoid the negative outcomes of solicitous responses is to promote  
23 facilitative and validating responses in partners. Partner facilitative responses—such as

1 encouraging approach-oriented coping and expressions of affection toward the person with  
2 pain—support adaptive coping while communicating support and sensitivity to the individual  
3 with chronic pain.<sup>49,50</sup> In addition, partners’ validating responses which indicate that partners  
4 understand (e.g., by saying reflective statements about the pain) and/or are trying to better  
5 understand the pain (e.g., by asking questions about the pain) can be beneficial for patients.<sup>51</sup>  
6 Expressing validating responses may contribute to better relationship quality and intimacy,<sup>52</sup> and  
7 it has also been found to relate to lower pain intensity.<sup>53</sup>

8         In the current study, we assessed perceptions of individuals with chronic pain about their  
9 partners’ burden and responses. Therefore, the actual level of burden and partner’s report of their  
10 own responses to the pain is not clear. Some studies have shown that patients’ and partners’  
11 perception about a specific variable may not be the same (e.g.,<sup>54,55</sup>). For example, partners tended  
12 to underestimate pain disability and overestimate pain intensity in patients compared to patient  
13 reports.<sup>55</sup> It is possible that when the measured variable has more external representations (i.e., it  
14 can be observed), individuals who express the behaviors and observers may have more similar  
15 estimations.<sup>55</sup> However, disagreement in patient-partner reports on pain-related variables (e.g.,  
16 pain intensity and pain behaviors) have not been observed in other studies (e.g.,<sup>56,57</sup>). The current  
17 study did not aim to investigate the level of disagreement between patients’ and their partners’  
18 report, but rather, the factors that mediated the link between pain expressions of the individuals  
19 with chronic pain and perceptions of their partners’ responses. Indeed, perceptions of individuals  
20 with chronic pain play an essential role in how they interpret their partners’ responses.<sup>54</sup> It is  
21 likely that individuals with chronic pain may not be able to observe and recognize all their  
22 partners’ responses to pain, or they even may label some responses differently than their  
23 partners.<sup>58</sup> In addition, some studies showed that even when both patients’ perceptions of their

1 partners' responses and their partners' report of their responses are related to patients' outcomes,  
2 patients' perceptions of their partners' responses play an independent role in predicting patients'  
3 outcomes.<sup>7</sup> Hence, patients' perceptions of their partners' responses and partners' responses both  
4 may have significant impact on patients' well-being and understudied variables (e.g., partner  
5 burden) should be assessed within the patients and their partners.

## 6 **Study limitations**

7         Several limitations of this work are noted. First, the cross-sectional nature of the current  
8 study prevented us from investigating the causal relationships among the variables in the  
9 conceptual model. Second, while previous research provided evidence on the validity of online  
10 data collections (e.g.,<sup>59,60</sup>) it should be mentioned that using an online data collection limited our  
11 reach only to individuals who were active online, especially on social media. Third, using self-  
12 report measures prevented us from having objective assessments of the actual pain behaviors,  
13 partner's burden, and partners' responses. Therefore, it is recommended that future studies  
14 include both patients and their partners' responses. In addition, in the current study, we examined  
15 the subjective perception of partners' burden and not the actual number of caregiving tasks and  
16 responsibilities that were performed by partners (i.e., objective burden). Future research may  
17 benefit from investigating the link between objective and subjective burden and also from  
18 investigating the link between patients' pain behaviors and their partners' objective and  
19 subjective burden. Finally, the majority of participants were female which decreases the  
20 generalizability of this study. This study has several strengths, including a large sample size of  
21 individuals with chronic pain. In addition, the findings provided empirical support for the  
22 importance of the interrelationships between perceived partner burden and relationship quality in  
23 perceptions of partner responses to pain.

## Conclusions

1  
2 Overall, considering the important role of partners' responses in the well-being of  
3 patients with chronic pain (e.g.,<sup>5-7</sup>), the current study advances the literature by identifying some  
4 of the factors (i.e., perception of partner burden and marital relationship) that may explain the  
5 relationship between patients' pain behaviors and their perception of their partners' responses.  
6 Identifying these factors is an important step for informing pain management programs because  
7 they suggest key targets of intervention for helping patients to have a better understanding of the  
8 factors that are linked to their perceptions of their partners' responses. Findings suggest that pain  
9 management programs should educate individuals with chronic pain about the possible  
10 relationship between their pain behaviors and their perceptions of their partners' burden and their  
11 relationship quality. In addition, patients should be aware that disclosing too many pain  
12 behaviors may be associated with perceiving more negative responses than perceiving solicitous  
13 or distracting responses. Finally, the findings of the current study highlight the importance of  
14 considering more adaptive ways of communicating pain to partners to avoid perceptions of  
15 partner burden and increase the probability of more adaptive responses such as facilitative and  
16 validating responses.

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