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Spouse confidence and physical function among adults with osteoarthritis: The mediating role of spouse responses to pain

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Abstract

Objective—This study of adults with osteoarthritis and their spouses examined spouse responses to patients' pain as potential mediators of the associations between spouse confidence in patients' ability to manage arthritis and improvements in patients' physical function and activity levels over time.

Methods—Participants were 152 older adults with knee osteoarthritis and their spouses. In-person interviews were conducted with patients and spouses (separately) at three time points: baseline (T1), six months after baseline (T2), and 18 months after baseline (T3). At each time point, patients reported their self-efficacy for arthritis management, functional limitations, and time spent in physical activity; spouses reported their confidence for patients' arthritis management and their empathic, solicitous, and punishing responses to patients' pain. Multiple mediation regression models were used to examine hypothesized associations across two distinct time frames: six months (T1–T2) and 12 months (T2–T3).

Results—Across six months, spouse confidence was indirectly related to improvements in patients' functional limitations and activity levels through increased empathic responses to patient pain. Across 12 months, spouse confidence was indirectly related to improvements in patients' functional limitations and activity levels through decreased solicitous responses to patient pain.

Conclusions—This study adds to the literature on spousal influences on health by identifying two spouse behaviors that help to explain how spouse confidence for patients' illness management translates into improvements in patients' physical health over time. Findings can inform the

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development of couple-focused illness management interventions aiming to increase the positive influence of the spouse on patients' health behaviors and outcomes.

Keywords

couples; chronic illness management; self-efficacy; partner responses to pain; longitudinal

Self-efficacy, or confidence in one's ability to perform the behaviors needed to achieve a desired outcome, is recognized as an important predictor of disease management and other health outcomes for individuals with a variety of chronic health conditions (Bandura, 1977; Marks, Allegrante, & Lorig, 2005). A small but compelling literature suggests that among couples, the *spouse or partner's* confidence in the patient's ability to engage in behaviors related to disease management is also important for the patient's health (e.g., Molloy et al., 2008; Rohrbaugh et al., 2004). However, the question of *how* spouse confidence may lead to improvements in patients' health remains largely unexplored. The current study sought to identify behavioral mechanisms through which spouse confidence affects the physical health of older adults with osteoarthritis. Specifically, we examined spouses' behavioral responses to patients' pain (i.e., empathic, solicitous, and punishing responses) as potential mediators of the effects of spouse confidence on change in osteoarthritis patients' functional limitations and physical activity levels over time.

Impact of self-efficacy and spouse confidence on patient health

An abundance of research shows the positive impact of self-efficacy on the health behaviors and health status of adults with chronic illness. People who are more confident in their ability to manage their disease (e.g., arthritis, diabetes) report better adherence to crucial health behaviors such as diet and exercise (King et al., 2010; Knittle et al., 2011). Patients with greater self-efficacy also experience better health outcomes over time, including reduced health care utilization and decreased illness severity (Brekke, Hjortdahl, & Kvien, 2001; Lorig et al., 2001).

A handful of studies indicate that for patients who are married, the spouse's confidence in the patient's ability to manage illness is also important for patient's health. As part of a study of couples in which the husband had recently had a myocardial infarction (MI), Taylor and colleagues (1985) showed that wives' confidence in their husbands' ability to tolerate increases in heart rate predicted husbands' performance on a treadmill task several months after the MI. Strikingly, wives' confidence predicted men's performance as well as the men's own self-efficacy did. Subsequent studies have linked spouse confidence to improvements in functional limitations among stroke survivors, survival rates among people with heart failure, and greater adherence to diet and exercise among people with diabetes (Johnson, Anderson, Walker, et al., 2013; Molloy et al., 2008; Rohrbaugh et al., 2004). Recently, spouse confidence was shown to predict improvements in arthritis patients' depressive symptoms, perceived health, lower extremity function, and illness severity (Gere, Martire, Keefe, Stephens, & Schulz, 2014).

Importantly, the majority of effects observed in these studies were independent of patients' baseline illness severity/disability and patients' self-efficacy for illness management,

suggesting that spouse confidence confers unique benefits to patients' health. That is, if two people have similar levels of impairment *and* self-efficacy, the person whose spouse is more confident in his or her ability to manage illness is likely to experience better health over time. To date, however, we know little about *how* spouse confidence may lead to such improvements in patients' health.

Potential pathways from spouse confidence to patient health

An understanding of the mechanisms through which spouse confidence benefits patients' health (particularly modifiable behavioral mechanisms) can inform couple-focused chronic illness interventions that aim to increase the positive influence of the spouse (Martire et al., 2013). One likely pathway is that spouse confidence impacts patient health by influencing the ways in which spouses respond to and get involved in patients' illness management. In his seminal work on self-efficacy, Bandura (1997) suggested that spouses' level of confidence in the patient's physical capabilities after a cardiac event helps determine their support (or hindrance) of patients' physical recovery. That is, spouses who are confident in their partners' ability to withstand physical activity after a cardiac event are likely to engage in behaviors that encourage or facilitate patients' activity. In contrast, spouses who lack confidence in their partners' abilities may discourage or prevent the patient from being active, which will ultimately hinder recovery.

For chronic pain conditions like arthritis, spouses' responses to patients' pain may be key behavioral mechanisms through which spouse confidence influences patients' physical health. The current study focuses on three types of spouse responses. Empathic or caring responses to pain refer to responses that convey understanding and emotional support; for example, a spouse may let the patient know that he/she is cared for (Cano, Barterian, & Heller, 2008; Stephens et al., 2006). Solicitous responses refer to instrumental actions aimed at alleviating patients' pain, such as taking over tasks for the patient (Kerns, Turk, & Rudy, 1985). Punishing responses refer to negative reactions, such as getting irritated when the patient expresses pain (Kerns et al., 1985).

According to traditional operant models of pain, empathic and solicitous responses reinforce patients' pain behaviors and avoidance of activities, leading to greater pain and disability over time, whereas punishing responses extinguish pain behaviors and lead to better outcomes over time (Turk, Kerns, & Rosenberg, 1992). Models of interpersonal relationships and social support, however, provide an alternative viewpoint. These models characterize empathic and solicitous responses as pain-specific forms of support, which may help individuals regulate emotions and cope with stress, thereby leading to less pain and better health outcomes over time; in contrast, punishing responses are viewed as unsupportive and posited to increase negative emotions and lead to poorer health outcomes (Cano et al., 2008; Cano & Williams, 2010; Evers, Kraaimaat, Geenen, Jacobs, & Bijlsma, 2003).

Research provides partial support for both of these viewpoints. Consistent with interpersonal models, spouses' empathic or caring responses have been linked to better emotional wellbeing among women experiencing lupus flare-ups (Fekete, Stephens, Mickelson, &

Druley, 2007). In addition, spouses' general emotional support has been linked to improvements in pain and physical function among people with chronic pain (Jamison & Virts, 1990; Waltz, Kriegel, & Bosch, 1998). Also consistent with models of support, punishing or negative responses have been linked to poorer patient outcomes, including greater emotional distress and pain and less activity engagement (Cano, Weisberg, & Gallagher, 2000; McCracken, 2005). In contrast, findings for solicitous responses are largely consistent with operant models of pain. Spouses' solicitous (i.e., instrumentally supportive) responses have been linked to poorer patient outcomes, including greater pain, less activity engagement, and poorer physical performance (Fillingim, Doleys, Edwards, & Lowery, 2003; McCracken, 2005). It is worth noting, however, that some studies have failed to find associations between solicitous responses and patients' physical function (Boothby, Thorn, Overduin, & Ward, 2004; Stroud, Turner, Jensen, & Cardenas, 2006).

It is clear that the ways in which spouses respond to patients' pain have consequences for patients' physical health. Spouse responses may be determined in part by their confidence in the patient's ability to manage pain and other illness symptoms. Previous studies of spousal support and responses to pain suggest that spouses who are more confident in patients' disease management abilities may be more likely to respond to patients' pain in ways that facilitate patients' physical functioning (i.e., empathic responses) and less likely to respond in ways that could hinder patients' physical functioning (i.e., solicitous and punishing responses) (Boothby et al., 2004; Johnson, Anderson, Wilcox, et al., 2013; Kuijer, Ybema, Buunk, & De Jong, 2000).

Current study

The purpose of the current study was to examine spouse responses to patient pain as mediators of the longitudinal associations between spouse confidence and patients' physical health among couples in which one partner has osteoarthritis (OA) of the knee. OA is a chronic condition in which cartilage around the joints deteriorates over time, leading to pain, stiffness, and loss of joint mobility. Knee OA, which is projected to affect half of all American adults during their lifetime, can result in significant limitations to patients' daily activities (Murphy et al., 2008). As such, maintaining physical function and promoting physical activity are primary goals of arthritis care. For this reason, the current study focused on functional limitations and physical activity levels as crucial indicators of patients' health. Recent research from the current sample shows that among couples, spouse confidence in patients' ability to manage OA predicts improvements in multiple aspects of patients' mental and physical health (Gere et al., 2014). No studies to date, however, have examined the links between spouses' confidence and their responses to pain, or the potential for these responses to explain *how* spouse confidence influences patients' physical functioning.

We predicted that spouse confidence in patients' ability to manage OA would be related to improvements in patients' functional limitations and activity levels *indirectly* through spouse responses to patients' pain. Specifically, we expected that spouses who had more confidence in the patient's abilities would report greater empathic responses and fewer solicitous and punishing responses, and that these responses would in turn relate to improvements in the patient's self-reported functional limitations and activity levels. Using existing data from a

larger three-wave panel study, we were able to test this hypothesis across two non-overlapping time frames: six months and 12 months.

Method

Participants and procedures

Data for the current study are from a larger, longitudinal study of older couples in which one partner (i.e., the patient) was diagnosed with knee OA (Martire et al., 2013). To be eligible, patients had to have been diagnosed with knee OA by a physician, experience usual knee pain of moderate or greater intensity, be at least 50 years of age, and be married or in a long-term relationship and living with their spouse or partner (hereafter referred to as the spouse). In order to ensure the quality of collected data, both partners had to be cognitively functional, as determined by the ability to correctly report the date, day of week, and their age and birth date. Couples were ineligible if the patient had a comorbid diagnosis of fibromyalgia or rheumatoid arthritis, used a wheelchair to get around, or planned to have hip or knee surgery in the next six months. Couples were also excluded if the spouse had arthritis pain of moderate or greater intensity, used a wheelchair to get around, or required assistance with personal care activities.

Primary sources of recruitment were research registries for rheumatology clinics and for older adults interested in research, flyers distributed at the University of Pittsburgh, and word of mouth. A total of 606 couples were screened for eligibility. Of these, 221 couples declined to participate; the most frequent reasons were lack of interest (N=87) and illness in the family (N=55). An additional 233 couples were ineligible for the study; the most frequent reasons were lack of OA of the knee (N=55) and OA pain that was mild (N=47). A total of 152 couples were enrolled in the study. Table 1 displays demographic characteristics of these couples.

Data for the larger study were collected via in-person interviews conducted over an 18-month period (T1=baseline; T2=6 months after baseline; T3=18 months after baseline). All procedures were approved by an Institutional Review Board, and written informed consent was obtained prior to baseline data collection. Interviews were conducted by trained staff in couples' homes, and patients and spouses were interviewed separately. Four couples dropped out of the study prior to T2, and five couples were unable to participate at T2 but returned for T3. Twelve couples dropped out of the study prior to T3. Common reasons for dropping out or being unable to participate were health issues, lack of time, and inability to contact. Approximately 94% (N=143) of the initial sample participated at T2, and 89.5% (N=136) participated at T3. We compared baseline characteristics of couples who dropped out of the study versus those who did not; the only significant difference was that patients who dropped out of the study had lower levels of physical activity compared to patients who did not drop out. One couple was excluded from the current analyses because the patient was an extreme outlier on one of the study outcomes (T3 physical activity). Due to missing data on one or more study variables, sample sizes for the current analyses were 139 couples for models examining the 6-month (T1-T2) time period and 127 couples for models examining the 12-month (T2-T3) time period.

Measures

Patient self-efficacy for arthritis management—At each time point, patients reported their confidence in managing arthritis symptoms using items from the Arthritis Self-Efficacy Scale (Lorig, Chastain, Ung, Shoor, & Holman, 1989). Five items assessed patients' confidence in managing their pain (e.g., How confident are you that you can decrease your pain quite a bit?), and six items assessed confidence in managing other OA-related symptoms (e.g., How confident are you that you can control your fatigue?). These 11 items were rated on a 10-point scale (1=not at all confident; 10=totally confident). Items were summed to create a total score of patients' self-efficacy with a possible range of 11–110. The mean at T1 was 74.86 ($SD=19.29$; $\alpha=.90$). The mean at T2 was 76.37 ($SD=18.80$; $\alpha=.92$). The mean at T3 was 76.18 ($SD=19.36$; $\alpha=.91$).

Spouse confidence for patients' arthritis management—At each time point, spouses responded to the same 11 items from the Arthritis Self-Efficacy Scale (Lorig et al., 1989), but items were modified to assess the spouse's confidence in the patient's ability to manage arthritis symptoms (e.g., How confident are you that your spouse can decrease his/her pain quite a bit?). Items were rated on a 10-point scale (1=not at all confident; 10=totally confident) and summed to create a total score of spouses' confidence for patients' arthritis management with a possible range of 11–110. The mean at T1 was 72.23 ($SD=17.36$; $\alpha=.87$). The mean at T2 was 72.00 ($SD=18.53$; $\alpha=.90$). The mean at T3 was 73.39 ($SD=20.65$; $\alpha=.91$).

Patient functional limitations—At each time point, patients reported the degree of difficulty they experienced performing various physical tasks during the past month using the 'physical function' subscale of the Western Ontario McMaster Universities Index (WOMAC; Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988). Seventeen items (e.g., What degree of difficulty have you had: rising from sitting, walking on flat ground?) were rated on a 5-point scale (0=none; 4= extreme). Items were summed to create a total score of functional limitations with a possible range of 0–68. The mean at T1 was 23.36 ($SD=10.70$; $\alpha=.91$), indicating a mild to moderate degree of difficulty performing physical tasks. The mean at T2 was 21.10 ($SD=12.20$; $\alpha=.94$). The mean at T3 was 21.27 ($SD=12.25$; $\alpha=.94$).

Patient physical activity—At each time point, patients reported the amount of time they spent engaging in routine physical tasks during a typical week in the past month using a subset of items from the Yale Physical Activity Survey (YPAS; DiPietro, Caspersen, Ostfeld, & Nadel, 1993). Thirteen items from the 'work', 'yardwork', and 'caretaking' subscales of the YPAS assessed hours per week spent in light to moderate routine physical activities (e.g., light housework, gardening, childcare). The 'exercise' and 'recreational activities' subscales were not administered in the larger study because the focus was on time spent in everyday work- and chore-related tasks. Items were summed to create a total score of hours spent in routine physical activity. The mean at T1 was 27.53 ($SD=17.95$). The mean at T2 was 27.59 ($SD=17.84$). The mean at T3 was 28.80 ($SD=19.50$).

Spouse responses to patient pain—At each time point, spouses reported the frequency of three different ways of responding to the patient's pain during the past month:

empathic, solicitous, and punishing responses. Empathic responses were measured using a scale from previous research (Stephens, Martire, Cremeans-Smith, Druley, & Wojno, 2006). Seven items assessed spouses' empathic responses (e.g., tried to put yourself in [the patient's] situation, showed [the patient] affection to comfort him/her). Solicitous and punishing responses were measured using subscales from the West Haven-Yale Multidimensional Pain Inventory (WHYMPI; Kerns, Turk, & Rudy, 1985). Five items assessed spouses' solicitous (i.e., instrumental) responses (e.g., took over [the patient's] jobs or duties to help him/her avoid pain, tried to get [the patient] to rest). Four items assessed spouses' punishing (i.e., negative) responses (e.g., got angry with [the patient], ignored [the patient]). All items were rated on a 7-point scale (0=never; 6=very often), and subscale scores were created by averaging items for each subscale. For empathic responses, the mean at T1 was 3.59 ($SD=1.21$; $\alpha=.82$), the mean at T2 was 3.53 ($SD=1.21$; $\alpha=.86$), and the mean at T3 was 3.61 ($SD=1.13$; $\alpha=.80$). For solicitous responses, the mean at T1 was 3.19 ($SD=1.46$; $\alpha=.74$), the mean at T2 was 3.17 ($SD=1.42$; $\alpha=.78$), and the mean at T3 was 3.27 ($SD=1.42$; $\alpha=.76$). For punishing responses, the mean at T1 was 1.58 ($SD=1.47$; $\alpha=.85$), the mean at T2 was 1.40 ($SD=1.36$; $\alpha=.87$), and the mean at T3 was 1.47 ($SD=1.36$; $\alpha=.84$).

Patient OA pain severity—At each time point, patients rated their typical OA pain severity by responding to the question “Overall, how would you describe the knee pain you usually had during the past month?”. This item was rated on a 5-point scale (1=none; 5=severe). The mean at T1 was 3.56 ($SD=.88$), indicating a mild to moderate level of pain. The mean at T2 was 3.21 ($SD=1.03$). The mean at T3 was 3.39 ($SD=.98$).

Bivariate correlations among major study variables are displayed in Table 2.

Analysis plan

Linear regression analyses examined spouses' empathic, solicitous, and punishing responses to patient pain as mediators of the longitudinal associations between spouse confidence and patients' functional limitations and physical activity across two distinct time periods: six months (T1-T2) and 12 months (T2-T3). Analyses were conducted using a macro created by Preacher and Hayes (2008) for estimating indirect effects in multiple mediator models. This macro applies a nonparametric bootstrapping technique to produce point estimates for 1) the total indirect effect (summed across all mediators) and 2) an individual indirect effect for each mediational pathway that controls for all other mediational pathways in the model. Bias-corrected 95% confidence intervals (CI) are used to determine the statistical significance of indirect effects; an effect is considered significant at $p < .05$ if the CI does not contain zero.

To provide a conservative test of our hypothesis, we used a baseline control approach to analyze change in both the mediators and outcomes (Finkel, 1995). For example, 6-month (T1-T2) change models examined whether spouses' empathic, solicitous, and punishing responses at T2 mediated the association between spouse confidence at T1 and patient functional limitations (or activity) at T2, controlling for each mediator and the outcome at T1. As such, models indicate whether change in spouses' responses to pain mediates the effect of spouse confidence on change in patients' functional limitations (or activity). This

approach minimizes the likelihood that any significant indirect effects of spouse confidence on patients' functional limitations (or activity) are due to preexisting differences in these outcomes or in spouse responses.

All models also controlled for patients' self-efficacy for arthritis management in order to ensure that any significant effects of spouse confidence were independent of the effects of patients' own self-efficacy. Additional covariates included patients' age, duration of OA, and typical level of knee pain, as these characteristics are likely to impact functional limitations and activity levels.

Results

Change in patients' functional limitations and physical activity levels

Prior to testing our hypothesis, descriptive analyses were conducted to determine how many patients exhibited positive or negative change (i.e., difference score greater or less than zero) in their functional limitations and physical activity levels across each time period. Across the 6-month period (T1-T2), 60% of patients showed decreases in functional limitations, 34% showed increases, and 6% showed no change. Half of all patients increased their physical activity, 49% decreased, and 1% showed no change. Across the 12-month period (T2-T3), 44% of patients showed decreases in functional limitations, 50% showed increases, and 6% showed no change. Nearly half (46%) of patients increased their physical activity, 49% decreased, and 5% showed no change.

Additional descriptive analyses were conducted to determine how many spouses showed change in their confidence for patients' arthritis management and their responses to patients' pain. Across the 6-month period, 48% of spouses increased their confidence, 50% decreased, and 2% showed no change. Half of spouses increased their empathic responses, 45% decreased, and 5% showed no change. Nearly half of spouses (48%) increased their solicitous responses, 43% decreased, and 9% showed no change. About one third of spouses (34%) increased their punishing responses, 44% decreased, and 22% showed no change. Across the 12-month period, 47% of spouses increased their confidence, 50% decreased, and 2% showed no change. Half of spouses (50%) increased their empathic responses, 43% decreased, and 7% showed no change. Half of spouses (49%) increased their solicitous responses, 43% decreased, and 8% showed no change. Less than half of spouses (43%) increased their punishing responses, 35% decreased, and 21% showed no change.

Indirect effects of spouse confidence on change in patient functional limitations and physical activity over six months (T1-T2)

Table 3 displays results of multiple mediator models that examined whether spouse confidence predicted change in patients' functional limitations and activity levels *indirectly* through change in spouses' empathic, solicitous, and punishing responses to patient pain. The first column presents estimates and standard errors of the direct effects, which represent the associations between spouse confidence and change in each given outcome controlling for all three mediators (i.e., the c' path). The second and third columns present bootstrapped point estimates and standard errors of the indirect effects, which represent the cross-product

of the coefficient between spouse confidence and a given mediator (i.e., the a path) and the coefficient between the given mediator and outcome (i.e., the b path). Finally, the fourth column presents the bias-corrected 95% confidence intervals (CI) for the indirect effects. For each outcome, estimates are provided for the total indirect effect (summed across all three mediators) and for each individual indirect effect (controlling for the other mediators).

Results from models examining change in patients' functional limitations and physical activity across six months (T1-T2) are displayed in the top half of Table 3. These models controlled for T1 assessments of the outcome and all mediators as well as patients' age, years diagnosed with OA, T1 arthritis self-efficacy, and T1 OA pain severity.

In partial support of our hypothesis, there was a significant indirect effect of spouse confidence on 6-month change in patients' functional limitations through spouses' empathic responses to patient pain (point estimate = $-.03$, $CI = -.10, -.002$). Higher levels of spouse confidence predicted increases in spouses' empathic responses ($B = .01$, $p = .01$), which in turn were related to decreases in patients' functional limitations ($B = -2.21$, $p = .03$). There were no significant indirect effects on patients' functional limitations through spouses' solicitous or punishing responses. This model accounted for 54% of the variance in patients' functional limitations (a model containing covariates only accounted for 51% of the variance).

Similarly, for change in patients' physical activity across six months, there was a significant indirect effect of spouse confidence through spouses' empathic responses to patient pain (point estimate = $.06$, $CI = .01, .17$). Higher levels of spouse confidence predicted increases in spouses' empathic responses ($B = .01$, $p = .02$), which were related to increases in patients' time spent in physical activity ($B = 4.72$, $p = .01$). There were no significant indirect effects of spouse confidence on patients' physical activity through spouses' solicitous or punishing responses. This model accounted for 45% of the variance in patients' physical activity (a model containing covariates only accounted for 40% of the variance).

Indirect effects of spouse confidence on change in patient functional limitations and physical activity over 12 months (T2-T3)

Results from models examining change in patients' functional limitations and physical activity across 12 months (T2-T3) are displayed in the bottom half of Table 3. These models controlled for T2 assessments of the outcome and all mediators as well as patients' age, years diagnosed with OA, T2 arthritis self-efficacy, and T2 OA pain severity.

In contrast to 6-month change models, but consistent with our hypothesis, there was a significant indirect effect of spouse confidence on 12-month change in patients' functional limitations through spouses' solicitous responses to patient pain (point estimate = $-.04$, $CI = -.10, -.01$). Higher levels of spouse confidence at T2 predicted decreases in spouses' solicitous responses ($B = -.02$, $p = .01$), which in turn were related to decreases in patients' functional limitations ($B = 2.36$, $p = .01$). There were no significant indirect effects of spouse confidence on 12-month change in patients' functional limitations through spouses' punishing or empathic responses. This model accounted for 43% of the variance in patients'

functional limitations (a model containing covariates only accounted for 35% of the variance).

Similarly, for change in patients' physical activity across 12 months, there was a significant indirect effect through spouses' solicitous responses (point estimate = .05, $CI = .001, .16$). Higher levels of spouse confidence at T2 predicted decreases in spouses' solicitous responses ($B = -.02, p = .02$), which were related to increases in patients' time spent in physical activity ($B = -3.29, p = .05$). There were no significant indirect effects of spouse confidence on 12-month change in patients' physical activity through spouses' punishing or empathic responses. This model accounted for 34% of the variance in patients' physical activity (a model containing covariates only accounted for 30% of the variance).

Discussion

This longitudinal study of older adults with knee OA and their spouses examined spouse responses to patient pain as mediators of the associations between spouse confidence for patients' OA management and change in patients' functional limitations and activity levels. Results revealed that spouses' empathic and solicitous responses to pain act as behavioral mechanisms that help to explain how spouse confidence leads to better health outcomes for patients over time.

Consistent with our hypothesis, spouses' empathic responses significantly mediated the associations between spouse confidence and change in both patient outcomes across a 6-month time frame. Specifically, spouses who reported greater confidence in patients' ability to manage OA were more likely to respond empathically (i.e., with understanding and emotional support) when patients experienced pain, and increased empathic responses from the spouse were linked to improvements in patients' functional limitations and physical activity levels.

To our knowledge, this is the first study to examine spouses' empathic responses to pain as a predictor of changes in patients' physical health. However, findings are in line with previous longitudinal work linking general emotional support to improvements in chronic pain patients' pain severity and physical activity (Jamison & Virts, 1990; Waltz et al., 1998). Empathic behaviors and emotional support from close others may lead to better health outcomes because they enhance patients' emotional wellbeing and feelings of intimacy (Cano & Williams, 2010; Fekete et al., 2007). Positive emotions are associated with better physical health and engagement in health-enhancing behaviors (Ong, 2010). Moreover, experimental research has shown that positive emotional states reduce perceptions of pain (Villemure & Bushnell, 2002). Thus, for people with chronic pain, spouses' caring responses may generate positive emotions that reduce pain perceptions and facilitate physical activity.

When examining patients' outcomes across a 12-month time frame, the effects of spouse confidence were mediated by spouses' solicitous responses. In line with our prediction, spouses who were more confident in the patient's ability to manage OA were *less* likely to respond to patients' pain with solicitous behaviors, and decreased solicitous responses were linked to improvements in patients' functional limitations and activity levels across 12

months. This finding is in line with numerous studies linking solicitous responses (which can also be characterized as instrumental support) to negative patient outcomes, including greater pain and pain interference, less activity engagement, and poorer physical function (e.g., Fillingim et al., 2003; McCracken, 2005).

Negative associations between solicitous responses and patient health are consistent with operant models of pain, which posit that solicitous responses from others reinforce patients' engagement in pain behaviors (i.e., overt expressions of pain and distress), thereby perpetuating such behaviors and leading to greater perceptions of pain and disability (Turk, Kerns, & Rosenberg, 1992). Notably, spouses likely intend to be helpful by offering instrumental assistance. However, taking over tasks or fetching items for the patient may inadvertently impair patients' physical function because it reinforces avoidance of undesirable activities (e.g., household chores) and reduces opportunities for the patient to be physically active. Many spouses report engaging in both empathic and solicitous responses to patients' pain, which appear to have opposite effects on patients' outcomes. Couple-focused interventions are needed to help spouses distinguish effective (vs. ineffective or potentially harmful) ways to respond to patients' pain, as suggested by early work on behavioral treatment of chronic pain (Fordyce et al., 1973).

Contrary to our hypothesis, we found no evidence that spouses' punishing responses (e.g., expressions of irritation, ignoring the patient) helped to explain the effects of spouse confidence on patients' functional limitations or activity levels across either time period. Cross-sectional studies have linked punishing responses to negative patient outcomes, including higher levels of pain severity and depressive symptoms and lower levels of relationship satisfaction and engagement in activities despite pain (Cano et al., 2000; McCracken, 2005; Raichle, Romano, & Jensen, 2011). Raichle and colleagues, however, failed to find an association between spouses' punishing responses and patients' physical function. It may be that punishing responses primarily impact patients' emotional and interpersonal wellbeing, or that effects on physical health do not endure across the time frames examined in this study.

Although we tested our conceptual model across two distinct time periods—six months and 12 months—these specific time periods were determined by the larger study from which this study derived, and we did not have theory-driven expectations that the indirect effects of spouse confidence on patients' physical health would differ across these two time frames. Thus, it was unexpected that the effects of spouse confidence on patients' functional limitations and activity levels were mediated by empathic responses across the 6-month time period, whereas these effects were mediated by solicitous responses across the 12-month time period. Because solicitous responses were somewhat less frequent than empathic responses, it may have taken longer for the effects of the former to emerge. However, this pattern of findings may also be due in part to the conservative nature of the analyses. Our models contained several control variables, and all three indirect pathways were modeled simultaneously. These conservative models may have made it difficult to detect significant indirect effects of smaller magnitude. Thus, our finding that the indirect effects of spouse confidence operate through different mechanisms over six months versus 12 months should be interpreted with caution until replicated.

Taken together, study findings support Bandura's assertion that spouses who are confident in the patient's abilities to manage their illness will act in ways that support patients' recovery, rather than in ways that may hinder patients' recovery (Bandura, 1997). To our knowledge, only one previous study has examined spousal behaviors as mediators of the association between spouse confidence and patient health. Molloy and colleagues (2008) failed to find evidence that perceived practical support from the spouse mediated the effects of spouse confidence on patients' functional limitations after a stroke. This null finding may have been due to their measure of support, which assessed perceptions of general practical assistance rather than support related specifically to recovery from stroke. A recent cross-sectional study found that spouses who were more confident in their partners' ability to manage type 2 diabetes were less likely to engage in two types of problematic support—overprotection (i.e., taking excessive responsibility for the partner's wellbeing) and protective buffering (i.e., hiding illness-related concerns from the partner); this study did not, however, examine these spouse behaviors in relation to patients' health (Johnson, Anderson, Wilcox, et al., 2013).

More research is needed to investigate spouses' supportive and unsupportive behaviors as mechanisms that may help to explain how spouse confidence benefits patients' health over time. For example, future studies could examine to extent to which patients' preferences for spousal support qualify the effects of spouses' confidence and responses to pain on patients' physical health. Previous research suggests that patients who desire or expect a high level of support from their spouses react more positively to spousal involvement in disease management, compared to patients who desire or expect less support (Martire, Stephens, Druley, & Wojno, 2002; Rook, August, Stephens, & Franks, 2011). In addition, other spouse attitudes or beliefs (e.g., critical attitudes regarding patient pain coping) may be of interest to researchers adopting different theoretical frameworks.

The current findings should be considered in light of study limitations. Notably, our conceptual model posits that spouse confidence influences spouse responses to patient pain, which in turn influence patient health outcomes. In the analyses, spouse confidence was assessed at a prior time point (T1 or T2), but changes in spouse responses and patient outcomes were assessed across concurrent time periods (T1-T2 or T2-T3). As such, we are unable to make definitive conclusions about the temporal sequence of effects. Although our results are consistent with the hypothesized mediational pathways, fully longitudinal models (with the IV, mediators, and DV assessed at different time points) are needed to confirm the presence of mediation and proposed temporal sequence. We tested fully longitudinal models across an 18-month time period (analyses not shown) and found no significant indirect effects of spouse confidence on patients' physical health; this suggests that if mediation exists, it does not endure over this length of time. We recommend that future studies use more frequent assessments (e.g., monthly, bimonthly) so that fully longitudinal models can be tested over shorter time frames.

Additionally, the current study relied on self-reported measures of patients' functional limitations and physical activity. Although the WOMAC and YPAS scales are common and well-validated self-report measures (Bellamy et al., 1988; Dipietro et al., 1993), findings would benefit from replication with objective measures of physical functioning. It is possible

that spouses' attitudes and behaviors have a greater impact on patients' *perceptions* of their physical functioning compared to their *actual* physical functioning.

Characteristics of the study sample may limit generalizability of the findings in multiple ways. Of note, the majority of couples in the study were in long-term, highly satisfying marriages. Some previous work suggests that spouse responses to pain have a weaker impact on patients' mental and physical health in the context of an unsatisfying marriage (Turk et al., 1992). Accordingly, the indirect effects of spouse confidence on patients' physical health observed in the current study may not apply to couples experiencing marital distress. Additionally, in order to be eligible for the study, patients had to report typical knee pain of moderate or greater intensity. As such, it is unclear whether findings extend to patients whose typical knee pain is less severe. The study's focus on spouse responses to pain may also limit the generalizability of findings to conditions for which pain is a primary symptom. However, we believe it is likely that spouse confidence influences spousal support and involvement more broadly across a range of health conditions. Finally, most of the participants were White, so we were unable to evaluate potential racial/ethnic differences in hypothesized associations.

In addition to these limitations, we would like to acknowledge alternate viewpoints of two constructs examined in our study. Solicitous and punishing responses are concepts that derive from traditional operant models of pain (Fordyce et al., 1973; Turk, Kerns, & Rosenberg, 1992). It is important to note, however, that these responses can also be conceptualized as types of pain-specific spousal support (Cano, 2004; Cano et al., 2008). The labels 'solicitous' and 'punishing' have been criticized for connoting a priori assumptions about the reinforcing or extinguishing qualities of these responses (Newton-John, 2002; Newton-John & Williams, 2006). Qualitative work by Newton-John and Williams (2006), for example, shows that spouse responses labeled as "solicitous" in common measures (including the measure used in the current study) are not necessarily delivered or perceived in a solicitous manner. Thus, it may be more appropriate to describe such responses as pain-specific instrumental support. Although we retained the traditional operant labels of solicitous and punishing responses in the current study in order to facilitate synthesis with previous literature, we acknowledge the limitations of these labels and encourage readers to consider alternate conceptualizations arising from models of interpersonal relationships and social support.

Despite its limitations, this study provided a strong test of our hypothesis in multiple ways. Analyses controlled for a number of variables known to impact patients' physical functioning (e.g., self-efficacy, pain severity) in order to isolate the unique effects of spouse confidence through responses to pain. By examining spouse confidence at a prior time point as a predictor of changes in spouse responses and patient outcomes, we reduced the likelihood that significant effects of spouse confidence were due to preexisting differences in these variables. Finally, spouses reported their confidence and responses to patient pain, whereas patients reported their functional limitations and activity; as such, findings were not biased by shared method variance that occurs when all variables are reported by one person.

Conclusion

The majority of middle-aged and older adults are married or in long-term partnerships, and spouses play an important role in influencing patients' illness management and health (Rosland, Heisler, & Piette, 2012; U.S. Census, 2013). The current study makes a novel contribution to our understanding of spousal influences on health by identifying two behavioral mechanisms—spouses' empathic and solicitous (i.e., instrumental) responses to patients' pain—that help to explain how spouse confidence for patients' illness management leads to improved physical functioning among adults with osteoarthritis. Studies that elucidate the processes through which spouses' attitudes and behaviors impact patients' health are crucial for the development of interventions that effectively target modifiable aspects of spousal influence in order to improve patient outcomes. Our findings suggest that couple-oriented interventions that enhance spouses' confidence in patients' abilities will improve spouse behaviors known to affect physical functioning. Strategies that may boost spouse confidence, such as observing patients' success and meeting goals together, could be explored in future work.

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Table 1

Demographic characteristics of baseline sample (N=152 couples).

Variable	Patients		Spouses	
	Mean (SD) or %	Range	Mean (SD) or %	Range
Age	65.78 (9.99)	50–95	65.32 (12.02)	21–91
Years of education	16.00 (2.02)	10–18	15.84 (2.05)	11–18
% female	58.55		40.79	
% White	86.84		84.87	
% Black	11.18		11.84	
Annual household income (median)	\$40,000–\$59,999			
Years married/in relationship	34.71 (16.89)	0–65		
Duration of OA (years)	16.42 (12.56)	1–67		

Table 2

Bivariate correlations among major study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 T1 sp. conf.	--																	
2 T2 sp. conf.	.62*	--																
3 T1 pt. self-eff.	.29*	.34*	--															
4 T2 pt. self-eff.	.27*	.35*	.72*	--														
5 T1 phys. lim.	-.24*	-.30*	-.37*	-.36*	--													
6 T2 phys. lim.	-.32*	-.40*	-.35*	-.44*	.69*	--												
7 T3 phys. lim.	-.25*	-.43*	-.33*	-.32*	.57*	.50*	--											
8 T1 phys. act.	.11	.03	.03	.002	.11	.09	.14	--										
9 T2 phys. act.	.10	.10	.02	.05	.17*	.03	.11	.60*	--									
10 T3 phys. act.	.01	-.01	.06	.08	.05	.08	.10	.42*	.46*	--								
11 T1 emp. resp.	.06	.05	-.11	-.07	.22*	.08	.04	-.02	.04	-.04	--							
12 T2 emp. resp.	.18*	.19*	-.05	-.10	.11	.01	.01	.05	.13	-.02	.63*	--						
13 T3 emp. resp.	.15	.06	-.04	-.01	.07	-.02	-.03	-.04	-.08	-.11	.63*	.64*	--					
14 T1 solic. resp.	-.11	-.15	-.17*	-.11	.29*	.16*	.11	-.03	.01	-.05	.65*	.48*	.40*	--				
15 T2 solic. resp.	-.06	-.07	-.10	-.15	.20*	.20*	.05	-.04	-.03	-.01	.50*	.72*	.43*	.63*	--			
16 T3 solic. resp.	-.10	-.15	-.15	-.10	.13	.10	.16	.01	-.06	-.14	.47*	.51*	.60*	.60*	.61*	--		
17 T1 pun. resp.	-.31*	-.38*	-.22*	-.18*	.23*	.26*	.14	-.004	-.08	-.04	.004	-.10	-.08	.13	.04	.06	--	
18 T2 pun. resp.	-.27*	-.39*	-.22*	-.22*	.22*	.25*	.21*	.05	-.05	-.03	-.06	-.01	-.02	.14	.18*	.15	.71*	--
19 T3 pun. resp.	-.24*	-.36*	-.24*	-.22*	.21*	.22*	.23*	-.07	-.06	-.07	.02	-.002	-.08	.10	.07	.13	.75*	.73*

Note: sp. conf. = spouse confidence; pt. self-eff. = patient self-efficacy; phys. lim. = physical limitations; phys. act. = physical activity; emp. resp. = empathic responses; solic. resp. = solicitous responses; pun. resp. = punishing responses

* p<.05

Table 3

Results of multiple mediator models examining indirect effects of spouse confidence on change in patients' functional limitations and physical activity through change in spouse responses to patient pain.

	Direct Effects (c')	Indirect Effects		
	B (SE)	Point Estimate	SE	Bias Corrected 95% CI
6-month models (T1-T2 change) ^a				
Functional limitations model				
T1 Spouse confidence	-.03 (.05)	-.02	.02	(-.077, .009)
T1-T2 Empathic responses		-.03 *	.02	(-.100, -.002)
T1-T2 Solicitous responses		.01	.02	(-.012, .060)
T1-T2 Punishing responses		-.0004	.01	(-.016, .010)
Physical activity model				
T1 Spouse confidence	-.06 (.08)	.05 *	.03	(.002, .129)
T1-T2 Empathic responses		.06 *	.04	(.012, .166)
T1-T2 Solicitous responses		-.01	.02	(-.079, .015)
T1-T2 Punishing responses		.001	.001	(-.013, .019)
12-month models (T2-T3 change) ^b				
Functional limitations model				
T2 Spouse confidence	-.14 (.06) *	-.02	.02	(-.077, .013)
T2-T3 Empathic responses		.02	.02	(-.006, .066)
T2-T3 Solicitous responses		-.04 *	.02	(-.103, -.007)
T2-T3 Punishing responses		-.001	.01	(-.022, .017)
Physical activity model				
T2 Spouse confidence	-.08 (.11)	.04	.04	(-.023, .127)
T2-T3 Empathic responses		-.02	.02	(-.098, .009)
T2-T3 Solicitous responses		.05 *	.04	(.001, .164)
T2-T3 Punishing responses		.01	.02	(-.035, .069)

* $p < .05$.

^a N=139.

^b N=127.