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## Psychosocial Factors and Adjustment to Chronic Pain in Persons With Physical Disabilities: A Systematic Review

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### Abstract

**Objective**—To systematically review the research findings regarding the associations between psychosocial factors and adjustment to chronic pain in persons with physical disabilities.

**Data Sources**—A key word literature search was conducted using articles listed in PubMed, PsychInfo, and CINAHL up to March 2010, and manual searches were made of all retrieved articles to identify published articles that met the review inclusion criteria.

**Study Selection**—To be included in the review, articles needed to (1) be written in English, (2) include adults with a physical disability who report having pain, (3) include at least 1 measure of a psychosocial predictor domain, (4) include at least 1 criterion measure of pain or patient functioning, and (5) report the results of associations between the psychosocial factors and criterion measures used in the study. Twenty-nine studies met the inclusion criteria.

**Data Extraction**—Three reviewers tabulated study details and findings.

**Data Synthesis**—The disability groups studied included spinal cord injury (SCI), acquired amputation, cerebral palsy (CP), multiple sclerosis (MS), and muscular dystrophy (MD). Psychosocial factors were shown to be significantly associated with pain and dysfunction in all disability groups. The psychosocial factors most closely associated with pain and dysfunction across the samples included (1) catastrophizing cognitions; (2) task persistence, guarding, and resting coping responses; and (3) perceived social support and solicitous responding social factors. Pain-related beliefs were more strongly associated with pain and dysfunction in the SCI, CP, MS, and MD groups than in the acquired amputation group.

**Conclusions**—The findings support the importance of psychosocial factors as significant predictors of pain and functioning in persons with physical disabilities. Clinical trials to test the efficacy of psychosocial treatments for pain and dysfunction are warranted, as are studies to determine whether psychosocial factors have a causal influence on pain and adjustment in these populations.

### Keywords

Amputation; Pain; Psychological adaptation

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Pain is a significant problem for many persons with physical disabilities,<sup>1</sup> including persons with SCI,<sup>2</sup> MS,<sup>3</sup> acquired amputation,<sup>4,5</sup> CP,<sup>6</sup> and MD.<sup>7</sup> Although physiologic changes associated with trauma or with the disability itself may play a primary causal role in the presence and severity of pain in persons with disabilities, psychosocial factors have long been hypothesized to play a role in the severity and impact of pain in many persons with physical disabilities and chronic pain.<sup>8–11</sup>

However, only recently have researchers begun to examine the hypothesized associations between psychosocial factors and measures of both pain severity and patient functioning in persons with disabilities. Such research is important because it provides us with an understanding of the importance of psychosocial factors as a whole (as they are related to key patient functioning variables). The findings from this research can also help determine which particular psychosocial variables might be most important to persons with disabilities. The specific psychosocial domains that have been studied by researchers in this area include (1) catastrophizing cognitions, (2) coping responses, (3) pain-related beliefs and attributions, and (4) social factors.

Catastrophizing has been defined as the tendency to focus on pain and negatively evaluate one's ability to deal with it.<sup>12</sup> Although it involves cognitions (thoughts and attributions) and so might be considered a belief or attitude domain,<sup>13</sup> catastrophizing has also been described as a type of social coping, given its potential for eliciting social support.<sup>14</sup> Whether viewed as an attitudinal set or coping response, there is general agreement that catastrophizing responses are more harmful than helpful. Catastrophizing has also been shown to be the strongest and most consistent psychosocial factor associated with pain and dysfunction in samples of persons with chronic pain as a primary presenting problem.<sup>12,13,15</sup>

Coping may be defined as efforts to manage stressful events. People can engage in pain coping efforts to decrease either pain severity or its negative impact on functioning. Pain-related beliefs and attributions, on the other hand, reflect a person's understanding of the causes of pain and pain's meaning with respect to their present and future quality of life. A large number of specific pain coping responses and pain-related beliefs have been identified, although most have been classified into those that are generally shown to be associated with poorer functioning ("maladaptive" beliefs and coping) and those that are generally shown to be associated with better functioning ("adaptive" beliefs and coping) in persons with chronic pain as a primary presenting problem.<sup>7,16</sup>

Two social factors have been the focus of research on social and environmental factors hypothesized to affect adjustment to chronic pain. First is general or global social support, which has been shown to be associated with positive functioning—in particular, positive psychological functioning—in samples of persons with chronic pain as a primary presenting problem.<sup>17</sup> Second are pain-contingent social responses, such as spouse or significant other solicitous responses (eg, offers to take over tasks or encouragement to become less active), which tend to be positively associated with measures of pain intensity and greater physical dysfunction in samples of persons with chronic pain as a primary presenting problem.<sup>17,18</sup>

The purpose of this systematic review is to review and summarize the findings from recent studies regarding the associations between psychosocial domains (specifically, catastrophizing, coping, beliefs, attributions, and social factors [including social support as well as pain-contingent social responses]) and pain and functioning in adults with physical disabilities. Although we sought to identify any study that examined these associations in any sample of persons with a physical disability diagnosis, as described in the Study Descriptions section, we were able to identify, and include in the review, only studies that included persons with SCI, acquired amputation, CP, MS, and MD.

The findings from these studies have important research and clinical implications. Because a significant association between variables is a necessary (but not sufficient) condition for causality, the findings from this research may be used to identify the factors that are more (or less) likely to have a causal influence on patient functioning. This research may therefore be used to identify those psychosocial factors that should be more closely examined in future experimental research. In addition, clinicians may use the findings from this research to determine whether interventions that target these psychosocial factors (eg, cognitive behavior therapy to alter pain-related catastrophizing, beliefs, and coping) should even be considered, because a lack of significant associations between psychosocial factors and adjustment could be used to support a decision not to address these factors in treatment. If so, until experimental studies are completed that elucidate the causal influence of changes in psychosocial variables on subsequent changes in patient function, the findings from correlational studies may be used by clinicians to identify those psychosocial factors they might choose to target first in treatment.

## METHODS

### Search Strategy

Three databases (PubMed, PsychInfo, CINAHL) were searched in March 2010 using 7 disability diagnoses (“spinal cord injury,” “multiple sclerosis,” “amputation,” “muscular dystrophy,” “stroke,” “traumatic brain injury,” “cerebral palsy”) with “pain” and with 5 additional key words (“coping,” “catastrophizing,” “beliefs,” “attributions,” “social support”). Thus, 35 searches were performed per database, 105 searches in all. The abstracts were read of those articles whose titles indicated they might have examined the associations between at least 1 psychosocial factor and pain or functioning in a sample of persons from these 7 disability groups. The entire article was read if the abstract indicated the article potentially met the inclusion criteria. References and bibliographic lists of all of these articles were also examined.

### Article Inclusion and Exclusion Criteria

In order to be included in this review, the article must have (1) been written in English, (2) included as participants adults with 1 or more of the 7 disability groups who also had or reported having pain, (3) included at least 1 measure of a psychosocial predictor domain (catastrophizing, belief, coping, or social factor), (4) included at least 1 criterion measure of patient functioning, and (5) reported the results of at least 1 statistical test examining the association between the psychosocial predictor factors and criterion measures used in the study. Article exclusion criteria were reports or studies that (1) were not published in peer-reviewed journals (eg, dissertations), (2) reported results using mixed samples of patients (eg, studies that used samples that mixed or included 2 different disability diagnoses or that included persons with a disability who did not necessarily experience pain), and (3) only used measures of psychosocial social domains that combined 1 or more possible psychosocial predictor with a criterion (ie, used measures that produced conceptual and statistical overlap between predictor and criterion variables, such as measures that result in a composite score consisting of a measure of pain coping and a measure of pain severity, making the interpretation of significant associations difficult).

### Data Extraction

Data extraction was completed by 3 of the authors (M.P.J., M.R.M., T.B.B.) using a form developed specifically for this purpose. The data extracted included (1) study author names, (2) publication dates, (3) study designs (eg, cross-sectional correlational, prospective predictive, longitudinal), (4) sample sizes, (5) diagnostic groups studied, (6) psychosocial predictor domains assessed and measures used to assess those domains, (7) criterion variable

(and control variable, when included) domains assessed (eg, pain severity, physical functioning, psychological functioning), (8) specific criterion domains assessed (eg, “depression,” “functional independence”) and measures used to assess those domains, (9) results of univariate analyses testing for zero-order associations between the psychosocial predictor factors and criterion variables, and (10) results of the multivariate analyses testing for associations between the psychosocial factors and criterion variables adjusting for control variables.

Results from both univariate and multivariate findings were extracted because each type of analysis addresses different questions. Univariate analyses examine the direct association between 1 predictor and 1 criterion variable. The statistic used most often to examine such a relationship is the correlation coefficient ( $r$ ). Although univariate analyses can determine the direct association between 2 variables, they cannot provide information regarding the possible reasons for the association found—for example, whether a third (confounding) variable might account for any significant association found.

Multivariate analyses, on the other hand, examine more complex associations between variables. Usually these analyses involve estimating the associations between 1 or more predictor variables and a criterion variable after statistically controlling for the effects of 1 or more other (possible) confounding variables. For example, if pain intensity has an influence on a predictor variable (such as frequency of pain coping responses) and also has an influence on a criterion variable (such as pain interference), then significant univariate associations between the predictor (coping) and the criterion variable (interference) could emerge because of their mutual association with the confounding variable (pain intensity), even if coping and pain interference have little direct association with each other. By statistically controlling for possible confounding variables, such as pain intensity, multivariate analyses can be used to provide better estimates of the associations between variables that are independent of the possible confounding variables included in the analyses.

Multivariate analyses can also allow one to determine whether a set of predictors as a group (eg, a set of or all of the psychosocial variables examined in a study) is significantly associated with a criterion variable, even when other important variables (eg, demographic or disease-related variables) are controlled. For example, if psychosocial factors play an important role in the experience or impact of pain in persons with a disability, one would hypothesize that psychosocial factors as a group would be significantly associated with psychological and physical functioning, even when controlling for pain intensity as well as demographic and disability-related variables. Multivariate analyses allow us to test this omnibus hypothesis.

## RESULTS

### Study Descriptions

Twenty-nine studies met the review inclusion criteria.<sup>19–47</sup> Fourteen of the studies used samples of adults with SCI, 9 used samples with acquired amputation, 3 used samples with CP, 2 used samples with MS, and 1 used a sample with MD (table 1). No study examining the associations between psychosocial predictors and functioning in stroke or traumatic brain injury were identified. The overwhelming majority of the studies included cross-sectional correlational analyses (24 [83%]). Two of these studies also included prospective predictive analyses to determine whether psychosocial factors assessed at 1 point in time predicted subsequent change in 1 or more criterion variables. An additional 2 studies only used prospective predictive analyses, for a total of 4 (14%) studies that included this type of

analysis. Two studies (7%) used a longitudinal design, examining the association between changes in psychosocial factors and changes in criterion variables over time.

The psychosocial domains examined most often in these studies were catastrophizing (assessed 22 [76%] times) and coping (assessed 21 [72%] times). Pain-related beliefs were assessed in 13 (45%) studies, and social factors were assessed in 12 (41%) studies. The only other psychosocial predictor domain assessed in these studies was “helplessness,” which was a composite measure made up of scales assessing catastrophizing and 2 coping responses (praying and hoping, increasing behavioral activities). This predictor variable was assessed in 2 (7%) studies.

The criterion domain assessed most often was psychological functioning (26 [90%] of the studies), but physical functioning (23 [79%]) and pain severity (22 [76%]) were also frequently measured. No other criterion domain was assessed nearly as often as these. Five (17%) of the studies reported only univariate associations. Ten (34%) of the studies performed only multivariate analyses, and 14 (48%) of the studies reported findings from both multivariate and univariate analyses.

### Associations Between Psychosocial Factors and Adjustment

Many specific psychosocial factor domains were assessed using a large number of different measures in the studies that were reviewed. Space limitations preclude summarizing the associations between each one of these and the criterion variables here; interested readers may obtain a copy of a table that lists details concerning all of the findings from these studies from the first author (mjensen@uw.edu). An overview of the primary findings from this body of research is presented in summary form in table 1 and discussed here. We first summarize the findings from multivariate analyses that tested whether psychosocial predictors assessed in any 1 study as a group contribute to the prediction of criterion variables (ie, measures of patient pain, physical functioning, psychosocial functioning) over and above control variables, such as pain intensity and demographic and clinical/disability-related variables. Next, we discuss the multivariate (ie, controlling for possible confounding variables) and univariate (ie, direct associations, not controlling for other variables) findings regarding the associations between the specific psychosocial factors (catastrophizing, coping, beliefs, social factors) measured most often in these studies, and measures of pain and functioning.

**Psychosocial predictor variables as a group predicting pain, physical function, and psychological functioning**—As mentioned, 24 studies presented findings from multivariate analyses (with 10 of these reporting only multivariate analysis results). In all 24 studies, at least 1, and often more than 1, of the psychosocial predictor variables examined were found to be statistically significantly associated with at least 1 criterion (pain or functioning) variable, even when controlling for other possible confounding variables.

Seventeen of these studies reported the  $R^2$  values associated with the concurrent cross-sectional multivariate analyses when a block of 1 or more psychosocial predictor variables were entered in a regression analysis to predict the criterion measures. These  $R^2$  values reflect the effect size (strength) of the associations found ( $R^2$  values between .02 and .13 reflect “weak” associations,  $R^2$  values between .13 and .35 indicate “medium” associations, and  $R^2$  values of .35 and larger indicate “strong” associations<sup>48</sup>). Six studies reported  $R^2$  for predicting pain severity or intensity.<sup>20,27,28,30,34,41</sup> The  $R^2$  values reported ranged from .19 (moderate effect size) to .43 (large effect size), with a median of .27 (medium effect size).

Fourteen studies reported 1 or more  $R^2$  values associated with the prediction of physical functioning (most often assessed using a measure of pain interference with activities).<sup>20–22,25,28,30,32–34,37,39,41,46,47</sup> The  $R^2$  values reported in these studies ranged from .06 (small effect size) to .31 (medium effect size), with a median of .16 (medium effect size). Fifteen studies reported 18  $R^2$  values associated with the prediction of psychological functioning, ranging from .07 (small effect size) to .58 (large effect size), with a median of .31 (large effect size).<sup>20–22,25,27,28,30,32–34,37,39,41,46,47</sup> No systematic differences emerged regarding the strengths of the associations between psychosocial predictors (as a group) and the criterion variables as a function of diagnosis.

In addition to consistent findings regarding the prediction of pain intensity or severity, psychological functioning, and physical functioning, the analyses from several of these studies also indicated that psychosocial factors were significantly associated with a global rating of quality of life<sup>19</sup> (acquired amputation sample), social integration<sup>43</sup> (SCI sample), and global ratings of general health<sup>47</sup> (SCI sample), even when controlling for demographic and clinical variables.

Longitudinal analyses reported in 2 studies of patients with acquired amputation indicated that as a group, psychosocial variables assessed soon after the amputation predicted subsequent changes in psychological functioning and physical functioning,<sup>25</sup> and that changes in psychosocial factors over time were significantly associated with changes in both psychological functioning and physical functioning.<sup>30</sup> In a SCI sample, changes in psychosocial variables as a group over the course of 6 months were associated with changes in pain and physical functioning.<sup>26</sup>

In sum, the findings from the multivariate analyses examining the ability of psychosocial factors as a group to predict pain and functioning provide strong and consistent support for the significant associations between psychosocial factors and measures of important patient functioning domains, even when controlling for patient demographic and clinical variables. Although there was some variability in the effect sizes associated with these analyses, the effects tended to be medium-to-large, and there was a tendency for the psychosocial predictors to be somewhat more strongly associated with measures of psychological functioning and pain severity than with measures of physical functioning. Analyses involving persons predictors, reported in the next section, shed light on the psychosocial factors most responsible for the significant associations found in the group multivariate analyses.

**Catastrophizing**—As indicated, 22 studies examined the association between pain-related catastrophizing responses and various criterion measures. In every study that examined this predictor, and even when controlling for demographic and clinical factors in multivariate analyses, catastrophizing evidenced strong and significant associations with measures of pain and functioning (see table 1).

In univariate analyses, when correlation coefficients were computed and reported, the median correlation coefficient between catastrophizing and measures of pain was .35 (range, .14–.68).<sup>24,27,34–36,42,43</sup> The median (absolute value) correlation coefficient between measures of catastrophizing and measures of physical functioning was .44 (range, .19–.67).<sup>32–37,42,43,47</sup> Finally, the median (absolute value) correlation coefficient between measures of catastrophizing and measures of psychological functioning was .53 (range, .23–.64).<sup>24,27,32–37,42,43,47</sup> The pattern of associations observed did not differ as a function of disability group.

In 1 longitudinal study, a change in catastrophizing over the course of 6 months showed moderately strong associations with changes in physical functioning (specifically, pain interference,  $r=.42$ ) and psychological functioning (specifically, as measured by the Medical Outcomes Study 36-Item Short-Form Health Survey Mental Health scale,  $r=-.41$ ) over this same period in an SCI sample.<sup>26</sup> Similarly, in a sample of persons with CP, an increase in catastrophizing over the course of 6 months was strongly and significantly associated with an increase in depression ( $r=.49$ ).<sup>29</sup> Moreover, higher levels of catastrophizing at 1 month postamputation predicted more improvement over the next 5 months in measures of both pain interference and depressive symptoms.<sup>30</sup>

**Coping factors**—As a general domain, coping was assessed in 21 of the studies, using a large variety of coping measures (see table 1). The coping responses that were shown to be associated with better outcomes (ie, less pain and/or better physical and psychological functioning) for 1 or more of the criterion variables in the studies using MS participants included (1) use of behavioral activities to distract oneself from pain,<sup>20</sup> (2) task persistence,<sup>34</sup> and (3) exercise and stretch.<sup>34</sup> Coping responses associated with poorer outcomes included use of (1) guarding,<sup>34</sup> (2) resting,<sup>34</sup> and (3) coping self-statements.<sup>34</sup>

In the acquired amputation studies, coping responses showing positive associations with better outcomes included (1) seeking social support,<sup>23</sup> (2) coping self-statements,<sup>27</sup> and (3) ignoring pain.<sup>27</sup> Coping responses showing associations with poorer outcomes in acquired amputation samples included (1) avoidance,<sup>23</sup> (2) problem-solving,<sup>23</sup> (3) increasing behavioral activities,<sup>28</sup> (4) reinterpreting pain sensations,<sup>28</sup> (5) resting,<sup>30</sup> (6) diverting attention,<sup>27</sup> (7) hoping and praying,<sup>27</sup> and (8) increasing behavioral activities.<sup>27</sup> One coping response, praying and hoping, showed inconsistent associations with the criterion variables (ie, more use, less pain, but also more physical dysfunction in a sample of patients with phantom limb pain).<sup>28</sup>

Nine studies examined coping responses in SCI samples. Of these, the coping strategies associated with more positive outcomes included (1) “acceptance” (eg, general acceptance,<sup>31</sup> acceptance of disability,<sup>40</sup> acceptance of spinal cord injury,<sup>35,36</sup> acceptance of “condition”<sup>47</sup>), (2) reinterpreting pain sensations,<sup>41</sup> (3) coping self-statements,<sup>41</sup> (4) ignoring pain sensations,<sup>41</sup> (5) task persistence,<sup>33,37</sup> (6) relaxation,<sup>26</sup> and (7) exercise.<sup>26</sup> Coping responses associated with negative outcomes included (1) general behavioral disengagement,<sup>31</sup> (2) venting emotions,<sup>31</sup> (3) passive coping,<sup>33,37</sup> (4) asking for assistance,<sup>33,37</sup> (5) guarding,<sup>37</sup> and (6) pacing.<sup>37</sup>

Three studies examined the associations between coping and criterion variables in samples with CP. Coping responses associated with poorer outcomes in these studies included (1) seeking social support,<sup>22</sup> (2) guarding,<sup>21</sup> (3) resting,<sup>21,29</sup> (4) relaxation,<sup>21</sup> and (5) asking for assistance.<sup>21</sup> Use of task persistence, on the other hand, was associated with less pain interference and better psychological functioning.<sup>29</sup>

One study examined the correlates of coping in a sample of patients with MD.<sup>32</sup> In this sample, use of guarding, resting, asking for assistance, relaxation, coping self-statements, seeking social support, and pacing were all associated with worse scores on 1 or more criterion variables. Only use of task persistence was associated with better criterion variable scores.

**Pain-related belief/attribution factors**—Beliefs were not assessed in the CP studies. In the 2 studies that examined the correlates of beliefs in MS samples, only belief in control over pain was associated with better pain/functioning scores.<sup>34</sup> Beliefs associated with negative outcomes in MS samples included (1) belief that pain is and will be constant,<sup>20</sup> (2)

belief in oneself as necessarily disabled by pain,<sup>34</sup> (3) belief that emotions influence pain,<sup>34</sup> and (4) belief that others should be solicitous in response to pain.<sup>34</sup>

In the 7 studies examining the associations between beliefs and criterion variables in SCI samples, 7 beliefs were associated with more positive scores on criterion measures: (1) belief in control over pain,<sup>26,33,37</sup> (2) belief in a medical cure for pain,<sup>37</sup> (3) belief in global self-efficacy (ability to engage in a range of daily tasks despite SCI),<sup>35,36</sup> (4) belief in pain-related self-efficacy,<sup>35,36</sup> (5) belief in general control over life,<sup>45</sup> (6) disease benefit (item example, “Dealing with my illness has made me a stronger person”),<sup>47</sup> and (7) internal pain control.<sup>47</sup> Six beliefs were associated with poorer outcomes: (1) belief in oneself as necessarily disabled by pain,<sup>26,33,37</sup> (2) belief that pain is an indication of physical damage and that activity should be avoided,<sup>26,37</sup> (3) belief that emotions influence pain,<sup>37</sup> (4) belief that others should be solicitous in response to pain,<sup>49</sup> (5) global helplessness,<sup>47</sup> and (6) external pain control.<sup>47</sup>

Four studies examined pain-related beliefs in persons with acquired amputation.<sup>25,27,28,30</sup> However, only 1 of these studies identified a significant association between a belief measure and a criterion variable, despite the fact that other psychosocial factors emerged as predictors in these studies. The single association found was a negative one between belief in self-efficacy over pain and pain severity.<sup>28</sup>

In the single study that examined the correlates of beliefs in persons with MD, Miró et al<sup>32</sup> found that (1) a belief in oneself as necessarily disabled by pain, (2) a belief that pain is a signal of physical damage, (3) a belief that others should be solicitous when one experiences pain, and (4) a belief that emotions influence pain were all associated with poorer functioning. On the other hand, in this same sample, a belief that one could control pain was associated with less pain interference and better psychological functioning.

**Social/environmental factors**—Thirteen studies examined social factors as the predictors of pain, physical functioning, and psychological functioning. Although significant associations were not always found,<sup>26</sup> when significant associations did emerge, more perceived social support was associated with better outcomes in persons with SCI,<sup>31,37</sup> acquired amputation,<sup>19,46</sup> MS,<sup>34</sup> and MD.<sup>32</sup> On the other hand, pain-contingent social responses (usually assessed as solicitous responses) tended to be associated with poorer outcomes in SCI samples,<sup>24,37,39</sup> although 1 study found that solicitous responses were positively associated with satisfaction with life.<sup>45</sup>

A series of longitudinal studies in persons with acquired amputation provide fairly consistent support for the potential importance of social factors in subsequent pain and functioning after amputation. For example, Williams et al<sup>46</sup> found that, controlling for baseline levels assessed at 1 month, general perceived social support assessed at 1 month postdischarge was associated with subsequent improvements in mobility and occupational functioning. Consistent with these findings, and after controlling for phantom limb pain intensity assessed at 1 month postamputation, general social support assessed at 1 month was associated with subsequent improvement (decreases) in both depression and pain interference, while solicitous responses were associated with a worsening (increase) in these criterion variables.<sup>30</sup> The finding regarding the association between general support and subsequent decreases in pain interference and solicitous responding and subsequent increases in pain interference was replicated in a separate sample of persons with newly acquired amputations.<sup>25</sup>



## DISCUSSION

The primary finding from this review is that measures of key psychosocial factors were all associated with important pain-related domains across 5 different disability groups. The findings also indicate many similarities and some interesting differences across and between the disability groups examined with respect to each of the psychosocial factors studied, and have important clinical and research implications.

### Psychosocial Predictors as a Group as Predictors of Criterion Variables

The findings from the multivariate regression analyses, in which possible confounding variables were controlled (often demographic and disability-related variables, as well as pain intensity, when predicting physical and psychological criterion variables), demonstrated that psychosocial factors as a group account for significant variance in the prediction of pain, physical functioning, and psychological functioning. The importance of psychosocial factors did not appear to vary as a function of disability diagnosis, suggesting that such variables are important to consider in each of the disability groups studied—that is, patients with SCI, acquired amputation, MS, CP, and MD.

However, there was variability in the amount of variance accounted for by the psychosocial factors as a function of criterion variable studied. Perhaps not surprisingly, the strongest effects tended to be associated with the prediction of psychological functioning, often indexed by measures of depression. However, psychosocial factors were also significantly associated with both pain severity and physical functioning.

Overall, these findings support the potential utility of bio-psychosocial models for understanding chronic pain in persons with disabilities. These results are also consistent with the large body of research supporting the greater utility of such comprehensive models of pain over models that focus only on biological factors (eg, “find it and fix it” models that seek to identify physiologic “pain generators” and focus treatment only on addressing those) in persons presenting with chronic pain as a primary complaint.<sup>50</sup>

The findings also indicate that all 3 criterion domains studied—pain, physical functioning, and psychological functioning—would be reasonable primary or secondary outcome domains in clinical trials examining the efficacy of psychosocial interventions in persons with disabilities and chronic pain. Focusing only on pain as an outcome variable, for example, might limit our understanding of the efficacy of treatment on multiple components of a patient’s quality of life. This view is consistent with that of consensus panels recommending that pain clinical trials assess multiple outcome domains and not limit themselves only to measures of pain intensity.<sup>51,52</sup>

### Catastrophizing

Consistent with research among persons with chronic pain as a primary presenting problem,<sup>53</sup> catastrophizing was significantly associated with measures of pain, physical functioning, and psychological functioning whenever these associations were tested. As did psychosocial factors as a group, catastrophizing showed some variability in the strength of association as a function of criterion domain. Its association with pain severity tended to be moderate (median coefficient=.35), its association with physical functioning tended to be in the moderate to strong range (median coefficient=.44), and its association with psychological functioning tended to be strong (median coefficient=.53). To the extent that catastrophizing is ultimately identified as a factor that affects, rather than merely reflects, pain and quality of life (see Research Implications section), the findings suggest that catastrophizing might have its biggest impact on psychological functioning, and perhaps only indirect, and weaker effects, on pain intensity or severity.<sup>54</sup>

## Coping

Coping variables were predictive of the criterion variables in all 5 disability groups. Given the large number of different coping measures used, identifying specific coping responses that are consistent predictors of the criterion variables across all disability groups is difficult. However, 1 coping response thought to be adaptive (task persistence) and 2 thought to be maladaptive (guarding and resting) demonstrated significant associations to the criterion in 4 of the 5 disability groups. Moreover, the relationships found (eg, task persistence associated with less pain and better functioning) were consistent with the coping responses classifications.<sup>55</sup> Thus, the findings suggest that these 3 coping responses may be particularly important to functioning in patients with disabilities and chronic pain.

In addition, and related to these 3 coping responses, there was a general pattern of associations suggesting that coping responses involving an “acceptance” of the pain and a switch in focus from engagement in passive coping to obtain pain relief (eg, avoidance, asking for assistance) to engagement in active and nonpain-focused coping (eg, increase behavioral activities, exercise, ignoring pain, coping self-statements) are associated with less pain and improved function.

## Beliefs

One of the interesting between-disability group differences that emerged was found in the correlates of pain-related beliefs. Beliefs were strongly associated with the criterion variables in persons with SCI, MS, and MD, but significant associations between pain-related beliefs and criterion variables were lacking in persons with acquired amputation (the CP studies did not assess beliefs). As discussed in the section “Social Factors,” however, social factors appeared to play a larger role in adjustment to pain in persons with acquired amputation than in other disability groups. This suggests the possibility, which would need to be confirmed by future research, that beliefs may be less important to pain and functioning for pain after amputations, relative to pain in SCI, MS, or MD.

The pattern of associations found for the specific beliefs studied, at least in persons with SCI, MS, and MD, is entirely consistent with research in persons with chronic pain as a primary problem—believing that one can control pain and its effects was associated with positive outcomes, and belief in oneself as necessarily disabled by pain, that others should be solicitous (and take care of the patient) when one experiences pain, and that pain is an indication of physical damage all tended to be associated with higher levels of pain and lower levels of psychological and physical functioning.<sup>16</sup>

## Social Factors

The findings regarding social factors are consistent with social support research as well as the operant model of pain.<sup>56</sup> The perception of social support was associated with less pain and better functioning—in particular, better psychological functioning. On the other hand, persons with disabilities and pain who report living in an environment where spouses or family members are solicitous in response to pain behaviors do more poorly. They report higher levels of pain and lower levels of physical functioning.

The social environment appears to be particularly important for persons with acquired amputation during the first few months after the amputation. Several studies found that social factors prospectively predict the development of phantom limb pain and physical functioning. Specifically, these studies found that patients who return to environments providing general social support, but lacking persons who are solicitous, are less likely to develop pain and report lower levels of physical dysfunction in weeks and months after the amputation.

## Treatment Implications

The pattern of findings regarding the psychosocial factors and measures of both pain and functioning is consistent with the goals of contemporary multidisciplinary pain treatment, which targets patient catastrophizing, pain-related beliefs and coping, and social factors, to improve psychological and physical functioning in persons with chronic pain. Although decreases in pain intensity tend not to be a focused goal of such treatment programs, decreases in pain are a common “side effect” of improvements in physical and psychological functioning.<sup>57</sup> Indeed, preliminary research examining the potential for such comprehensive treatment programs to benefit persons with disabilities and pain is very promising.<sup>58–60</sup>

The field of rehabilitation medicine has been a leader in recognizing the importance of psychosocial variables as influencing treatment outcomes in medical settings. Part of the reason for this leadership has been rehabilitation medicine’s focus on functional outcomes and the clear understanding that how well an individual functions in day-to-day life is determined by biological, psychological, and social factors. The findings from this review provide empirical support for this biopsychosocial perspective and indicate that continued use of this model is warranted.

Although strong and consistent associations between psychosocial factors and criterion variables do not ensure that the psychosocial factors play a causal role in adjustment to chronic pain in persons with disabilities, a lack of association does suggest that a psychosocial factor is not likely to play an important role, at least for the average patient. Thus, the psychosocial factors found to be most strongly associated with pain and functioning are more likely to be important than those not found to be associated. They represent the “low-hanging fruit” that clinicians may wish to target in treatment. Based on this reasoning, of the psychosocial factors examined in this body of research, reasonable goals of treatment would be to reduce (1) catastrophizing cognitions; (2) guarding and resting as coping responses; (3) the beliefs that one is necessarily disabled by pain, that others should be solicitous when one experiences pain, and that pain is an indication of physical damage; and (4) solicitous environmental responses to pain behaviors. At the same time, it would be reasonable to help patients (1) increase the use of coping strategies such as task persistence, acceptance of disability, behavioral activities, exercise, ignoring pain, and coping self-statements; (2) increase the belief that the patient can control pain and its effects; and (3) help the patient seek and obtain more general (nonpain-contingent) social support. For patients who have recently undergone an amputation, interventions that build capacity for or that directly provide for global emotional support and that reduce or eliminate the presence of solicitous responses (ie, spouse or family training) may be particularly important to reduce the frequency of pain and disability in this population.

## Research Implications

Given the findings of this review, as well as the promising preliminary findings regarding the potential for psychosocial interventions to benefit persons with disability and chronic pain,<sup>58–60</sup> full clinical trials testing the efficacy of such interventions are clearly warranted. Such interventions could be modeled, at least in part, on psychosocial interventions that have proven efficacy for persons with chronic pain as a presenting problem, including coping skills training<sup>53,61</sup> and other cognitive-behavioral interventions.<sup>62,63</sup> In order to make such interventions most applicable to persons with disabilities, it would be reasonable to include components that target the psychosocial factors found to be most closely associated with pain and functioning in the current review, and listed in the Treatment Implications section.

One strategy for making such clinical trials even more useful and for moving our understanding forward is to build in the possibility to perform a process analysis.<sup>49,64–67</sup> Specifically, if, for example, (1) catastrophizing; (2) task persistence, guarding, and resting coping; (3) control, disability, and harm beliefs; and (4) social support and family solicitous responding were targeted, then measures of these variables in addition to the study outcome variables could be administered pretreatment, mid-treatment, and at posttreatment. Once tests of the efficacy of the intervention on outcome variables (eg, pain, pain interference, psychological function) are completed, and if the treatment is found to be efficacious, follow-up process analyses could be performed to determine which psychosocial variables are also affected by treatment (relative to the control condition). A third step would be to determine which psychosocial (process) variables explain the changes that were found in outcome,<sup>67</sup> or alternatively to determine whether pretreatment to midtreatment changes in process variables predict subsequent midtreatment to posttreatment improvement.<sup>49</sup> Such analyses would identify the psychosocial variables that would be most likely to play an important causal role in influencing outcome. This information could then be used to modify treatments to focus on those psychosocial process variables that are most important, thereby making the interventions even more effective and efficient.

Longitudinal studies can also be envisioned that could help elucidate the importance of psychosocial factors as predictors of the development of chronic pain. A recent review of longitudinal studies, for example, found that high levels of maladaptive pain coping behaviors (as indicated by higher levels of avoidance and catastrophizing) within 8 weeks of new-onset low-back pain were among the strongest predictors of the subsequent development of chronic low-back pain.<sup>68</sup> It would be useful to determine which of the many psychosocial factors that demonstrate significant concurrent associations with pain and dysfunction in persons with physical disabilities also predict subsequent worsening (or improvement) in pain and dysfunction.

The findings from this review also support the continued development of interdisciplinary research that examines disability from a biopsychosocial perspective. If psychosocial factors play an important role in pain and its impact, it is possible that these factors also play an important role in other symptoms and problems in persons with disabilities (eg, fatigue, sleep difficulties) as well as in the impact of rehabilitation medicine interventions. The results therefore support a consideration for incorporating psychosocial variables in other rehabilitation outcome research studies. This could serve not only to increase our understanding of the role that psychosocial factors have in impacting the outcomes of our treatments but also to enhance those outcomes as our understanding improves and as we increasingly adapt our interventions to incorporate psychosocial variables as treatment targets.

### Study Limitations

This review was limited by the studies that were identified for inclusion. No studies were found that studied psychosocial factors as predictors of criterion variables in disability groups other than SCI, acquired amputation, MS, CP, and MD, including traumatic brain injury and stroke, despite the fact that pain is known to be a frequent problem in other disability populations.<sup>69,70</sup> Also, there were very few studies of MS, CP, and MD. Thus, evidence for the generalizability of the findings across other disability groups, and the reliability of the findings with respect to MS, CP, and MD, are limited.

Although a large number of psychosocial variables were examined in the studies reviewed, additional factors may prove to be important to adjustment to pain in disability, such as mindfulness,<sup>71–73</sup> “appreciation” or finding value,<sup>74</sup> thought control (ie, strategies for coping with thoughts, such as distraction from thoughts or focusing on different thoughts),<sup>75</sup>

and benefit finding,<sup>76,77</sup> each of which has been associated with positive functioning in persons managing pain, distress, or illness. Because these other factors are identified as being potentially important to adjustment to pain, research will be needed to determine their association with pain and functioning in persons with disabilities and pain, and ultimately to determine whether treatments that target these additional factors benefit these persons.

## CONCLUSIONS

Despite the limitations of this review, the findings provide clear support for comprehensive biopsychosocial models for understanding chronic pain in adults with physical disabilities, including persons with SCI, acquired amputation, CP, MS, and MD. The findings also provide the clinician with a list of psychosocial factors that are more likely than others to play an important role in the person's experience of pain and its impact on physical and psychological functioning. The results therefore provide an empirical guide for determining which psychosocial factors are most reasonable to target in treatment at this time—at least until clinical trials and associated process analyses provide evidence for the possible causal role that these factors may play in patient functioning and treatment outcome. Ultimately, research in this area, including clinical trials that test interventions for persons with disabilities and chronic pain, will help identify the most effective ways to help these persons hurt less and do more. This research should therefore contribute to helping people with disabilities and pain focus less on pain and more on activities that give their lives the most satisfaction and meaning.

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## List of Abbreviations

<b>CP</b>	cerebral palsy
<b>MD</b>	muscular dystrophy
<b>MS</b>	multiple sclerosis
<b>SCI</b>	spinal cord injury

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**Table 1**

Summary of Findings From Studies Examining the Associations Between Psychosocial Factors and Measures of Symptoms and Functioning in Persons With Physical Disabilities (SCI, Acquired Amputation, MS, CP, MD)

Author, Year; Study Design; Total Sample Size	Psychosocial Domains Measured	Criterion Variables	Primary Findings
Asano et al, 2008 <sup>19</sup> ; Cross-sectional correlational design; N=415 (acquired amputation)	Social	Psychological functioning	Multivariate analyses Perceived social support (+*) accounted for unique variance in psychological functioning.
Douglas et al, 2008 <sup>20</sup> ; Cross-sectional correlational design; N=105 (MS)	Catastrophizing Coping Beliefs	Pain Physical functioning Psychological functioning	Multivariate analyses Pain constancy (-) and ability to decrease pain (+) beliefs accounted for unique variance in pain intensity. Catastrophizing (-) and constancy (-) beliefs accounted for unique variance in physical functioning. Catastrophizing (-) and increasing activities (+) coping accounted for unique variance in psychological functioning.
Engel et al, 2006 <sup>21</sup> ; Cross-sectional correlational design; N=59 (CP)	Catastrophizing Coping	Pain Physical functioning Psychological functioning	Multivariate analyses Catastrophizing (-) accounted for unique variance in psychological functioning. Seeking social support (-) accounted for unique variance in pain interference.
Engel et al, 2000 <sup>22</sup> ; Cross-sectional correlational design; N=50 (CP)	Catastrophizing Coping	Pain Physical functioning Psychological functioning	Multivariate analyses Catastrophizing (-) and praying/hoping (+) coping accounted for unique variance in pain interference. Catastrophizing (-) accounted for unique variance in psychological functioning. Univariate analyses Catastrophizing (-) significantly associated with pain interference and depression. Guarding (-), resting (-), and relaxation (-) coping significantly associated with pain interference. Resting (-), asking for assistance (-), and relaxation (-) coping significantly associated with depression.
Gallagher and MacLachlan, 1999 <sup>23</sup> ; Cross-sectional correlational design; N=44 (acquired amputation)	Coping	Pain Psychological functioning	Multivariate analyses Seeking social support (+), avoidance (-), and problem-solving (-) coping accounted for unique variance in residual limb pain intensity. Avoidance (-) coping accounted for unique variance in psychological functioning.
Giardino et al, 2003 <sup>24</sup> ; Cross-sectional correlational design; N=74 (SCI)	Catastrophizing Social	Pain Psychological functioning	Univariate analyses Catastrophizing (-) significantly associated with psychological functioning, affective pain severity, and sensory pain severity. Solicitous responses (-) significantly associated with affective pain severity.
Hanley et al, 2004 <sup>25</sup> ; Prospective predictive longitudinal design; N=70 (acquired amputation)	Catastrophizing Coping Beliefs Social	Pain Physical functioning Psychological functioning	Multivariate analyses Social support (+) and solicitous responses (-) at 1- mo postamputation accounted for significantly unique variance in 12-mo change in physical functioning. Catastrophizing (+) at 1-mo postamputation accounted for significantly unique variance in 12-mo change in psychological functioning. Catastrophizing (+), social support (+), and solicitous responses (-) at 1-mo postamputation accounted for significantly

Author, Year; Study Design; Total Sample Size	Psychosocial Domains Measured	Criterion Variables	Primary Findings
Hanley et al, 2008 <sup>26</sup> ; Longitudinal (change score) correlational design; N=40 (SCI)	Catastrophizing Coping Beliefs Social	Pain Physical functioning Psychological functioning	<p>unique variance in 24-mo change in physical functioning. Catastrophizing (+) accounted for significantly unique variance in 24-mo change in psychological functioning.</p> <p>Multivariate analyses Change in control beliefs (+) and catastrophizing (-) accounted for unique variance in physical functioning. Change in control (+) and catastrophizing (-) accounted for unique variance in psychological functioning. Univariate analyses Change in control beliefs (+) and exercise/stretch coping (+) significantly associated with change in pain intensity, pain interference, and psychological functioning. Change in catastrophizing (-) and disability beliefs (-) significantly associated with change in pain interference and psychological functioning. Change in harm beliefs (-) and relaxation (+) significantly associated with change in psychological functioning.</p>
Hill, 1993 <sup>27</sup> ; Cross-sectional correlational design; N=60 (acquired amputation)	Catastrophizing Coping Beliefs "Helplessness"	Pain Psychological functioning	<p>Multivariate analyses Catastrophizing (-) accounted for unique variance in pain severity and psychological functioning. Univariate analyses Catastrophizing (-) significantly associated with both pain severity and emotional distress. Diverting attention (-), hoping and praying (-), increasing behavioral activities (-), and coping self-statements (+) coping significantly associated with both pain severity and emotional distress. Ignoring pain sensations (+) significantly associated with pain severity.</p>
Hill et al, 1995 <sup>28</sup> ; Cross-sectional correlational design; N=228 (acquired amputation)	Catastrophizing Coping Beliefs "Helplessness"	Pain Physical functioning Psychological functioning	<p>Multivariate analyses Helplessness and self-efficacy beliefs accounted for unique variance in pain severity. Catastrophizing (-) accounted for unique variance in pain, physical functioning, and psychological functioning. Increasing behavioral activities coping (-) accounted for unique variance in pain severity. Ability to decrease pain beliefs (+) accounted for unique variance in pain. Praying and hoping coping accounted for unique variance in pain severity (+) and physical functioning (-). Reinterpreting pain sensations coping (-) accounted for unique variance in psychological dysfunction.</p>
Jensen et al, 2006 <sup>29</sup> ; Longitudinal (change score) correlational design; N=48 (CP)	Catastrophizing Coping	Pain Physical functioning Psychological functioning	<p>Multivariate analyses Change in task persistence coping (+) accounted for unique variance in change in pain interference and psychological functioning. Change in catastrophizing (-) and resting coping (-) accounted for unique variance in change in psychological functioning. Univariate analyses Findings above were replicated in the univariate analyses.</p>

Author, Year; Study Design; Total Sample Size	Psychosocial Domains Measured	Criterion Variables	Primary Findings
Jensen et al, 2002 <sup>30</sup> ; Cross-sectional and longitudinal prospective prediction design; N=61 (acquired amputation)	Catastrophizing Coping Beliefs Social	Pain Physical functioning Psychological functioning	Multivariate analyses Catastrophizing (-) accounted for significantly unique variance in pain, physical functioning, and psychological functioning. Resting coping (-) accounted for significantly unique variance in pain and physical functioning. Catastrophizing (+), social support (+), and solicitous responses (-) assessed at 1-mo postamputation made unique contributions to subsequent change in pain intensity and physical functioning.
Kennedy et al, 1995 <sup>31</sup> ; Cross-sectional correlational design, including many statistical tests of many subgroups; n=41 (6wk =postinjury) (SCI) n=30 (4-7y postinjury); (SCI)	Coping Social	Physical functioning Psychological functioning	Multivariate analyses Acceptance (+), behavioral disengagement (-), and venting emotions (-) coping accounted for unique variance in psychological functioning. Univariate analyses In the 6-wk postinjury group, positive reinterpretation (+), active coping (+), acceptance (+), venting emotion (-), behavioral disengagement (-), denial (-), alcohol/drug use (-) coping, and social support (+) were all significantly associated with psychological functioning. In the group 4-7y postinjury group, religion (+), acceptance (+), mental disengagement (-), venting emotion (-), behavioral disengagement (-), denial (-), and alcohol/drug abuse (-) coping, and social support (+) were all significantly associated with psychological functioning.
Miró et al, 2009 <sup>32</sup> ; Cross-sectional correlational design; N=182 (MD [type 1 myotonic muscular dystrophy and facioscapulohumeral muscular dystrophy])	Catastrophizing Coping Beliefs Social	Pain Physical functioning Psychological functioning	Multivariate analyses Catastrophizing (-), social support (+), and emotional and solicitude beliefs (-) accounted for unique variance in psychological functioning. Catastrophizing (-), social support (+), disability and harm beliefs (-), and passive coping (-) accounted for unique variance in physical functioning. Univariate analyses Catastrophizing (-); disability (-), harm (-), solicitude (-), and control (+) beliefs; and social support (+) significantly associated with physical functioning and psychological functioning. Guarding (-), resting (-), asking for assistance (-), relaxation (-), coping self-statements (-), seeking social support (-), and pacing (-) coping significantly associated with physical functioning. Resting (-), relaxation (-), and task persistence (+) coping significantly associated with psychological functioning. Disability (-), harm (-), control (+), and solicitude beliefs significantly associated with pain interference and psychological functioning. Emotion beliefs (-) significantly associated with psychological functioning. Perceived social support (+) significantly associated with pain interference and psychological functioning.
Molton et al, 2009 <sup>33</sup> ; Cross-sectional correlational design; N=130 (SCI)	Catastrophizing Coping Beliefs	Physical functioning Psychological functioning	Multivariate analyses Disability conviction (-) and catastrophizing (-) accounted for unique variance in psychological functioning.

Author, Year; Study Design; Total Sample Size	Psychosocial Domains Measured	Criterion Variables	Primary Findings
Osborne et al, 2007 <sup>34</sup> ; Cross-sectional correlational design; N=125 (MS)	Catastrophizing Coping Beliefs Social	Pain Physical functioning Psychological functioning	<p>Passive coping (-) and catastrophizing (-) accounted for unique variance in physical functioning.</p> <p>Univariate analyses Catastrophizing (-), control (+), and disability (-) beliefs significantly associated with psychological functioning and physical functioning.</p> <p>Harm beliefs (-) and resting (-), asking for assistance (-), and task persistence (+) coping significantly associated with physical functioning.</p> <p>Multivariate analyses Catastrophizing (-) accounted for unique variance in pain intensity, physical functioning, and psychological functioning.</p> <p>Univariate analyses Control beliefs (+) significantly associated with pain intensity and psychological functioning.</p> <p>Catastrophizing (-), social support (+), and disability beliefs (-) and resting coping (-) significantly associated with pain intensity, physical functioning, and psychological functioning.</p> <p>Emotion (-) and solicitude beliefs (-) and exercise/stretching (+) coping significantly associated with physical functioning and psychological functioning.</p> <p>Guarding (-), task persistence (+), and coping self- statements (-) coping significantly associated with physical functioning.</p>
Perry et al, 2009 <sup>35</sup> ; Cross-sectional correlational design; N=45 (SCI)	Catastrophizing Coping Beliefs	Pain Physical functioning Psychological functioning	<p>Univariate analyses Catastrophizing (-) and self-efficacy beliefs (+) significantly associated with pain intensity, physical functioning, and psychological functioning.</p> <p>Acceptance coping (+) significantly associated with physical functioning and psychological functioning.</p>
Perry et al, 2009 <sup>36</sup> ; Cross-sectional correlational design; N=47 (most pain-related analyses run using 36 subjects w/pain) (SCI)	Catastrophizing Coping Beliefs	Pain Physical functioning Psychological functioning	<p>Univariate analyses Self-efficacy (+) significantly associated with pain, physical functioning, and psychological functioning.</p> <p>Catastrophizing (-) significantly associated with pain and psychological functioning.</p> <p>Acceptance (+) significantly associated with psychological functioning.</p>
Raichle et al, 2007 <sup>37</sup> ; Cross-sectional correlational design; N=157 (SCI)	Catastrophizing Coping Beliefs Social	Pain Physical functioning Psychological functioning	<p>Multivariate analyses Catastrophizing (-), social support (+), and emotional and solicitude beliefs (-) accounted for unique variance in psychological functioning.</p> <p>Catastrophizing (-), pain as illness beliefs (-), and passive coping (-) accounted for unique variance in physical functioning.</p> <p>Univariate analyses Catastrophizing (-); harm (-), solicitude (-), and control (+) beliefs; task persistence coping (+); and social support (+) significantly associated with physical functioning and psychological functioning.</p> <p>Medication (-) and medical cure (-) beliefs; guarding (-), resting (-), asking for assistance (-), and pacing (-) coping; and solicitous (-) responses significantly associated with physical functioning.</p>

Author, Year; Study Design; Total Sample Size	Psychosocial Domains Measured	Criterion Variables	Primary Findings
Richardson et al, 2007 <sup>38</sup> ; Prospective prediction study; N=52 (acquired amputation)	Catastrophizing Coping	Pain	Emotion (-) and disability (-) beliefs significantly associated with psychological functioning.  Univariate analyses Passive coping (-) assessed at preamputation was significantly associated with the presence of phantom limb pain 6mo postamputation. Catastrophizing (-) and praying/hoping coping (-) at preamputation significantly associated with presence of phantom limb pain 6mo postamputation.
Stroud et al, 2006 <sup>39</sup> ; Cross-sectional correlational design; N=70 (SCI)	Social	Pain Physical functioning Psychological functioning	Multivariate analyses Negative social response to pain (-) accounted for unique variance in physical functioning. Negative social responses (-) and distracting social responses (-) accounted for unique variance in psychological functioning. Univariate analyses Negative social response (-) significantly associated with psychological functioning, physical functioning, and pain intensity. Solicitous social responses (-) significantly associated with physical functioning. Social support satisfaction (+) significantly associated with psychological functioning.
Summers et al, 1991 <sup>40</sup> ; Cross-sectional correlational design; N=54 (SCI)	Coping Social	Pain	Multivariate analyses Acceptance of disability coping (+) and punishing responses (-) accounted for unique variance in pain severity. Univariate analyses Acceptance of disability coping (+) and punishing responses (-) significantly associated with pain severity.
Turner et al, 2002 <sup>41</sup> ; Cross-sectional correlational design; N=174 (SCI)	Catastrophizing Coping	Pain Physical functioning Psychological functioning	Multivariate analyses Catastrophizing (-) accounted for unique variance in pain, physical functioning, and psychological functioning. Reinterpreting pain sensations (-), coping self-statements (+), and ignoring pain (+) coping accounted for unique variance in psychological functioning.
Ullrich et al, 2007 <sup>42</sup> ; Cross-sectional correlational design; N=237 (SCI)	Catastrophizing	Pain Physical functioning Psychological functioning Community integration	Univariate analyses Catastrophizing (-) significantly associated with pain, physical functioning, psychological functioning, and community integration.
Ullrich et al, 2008 <sup>43</sup> ; Cross-sectional correlational design; N=421 (Veterans and nonveterans with SCI)	Catastrophizing	Pain Physical functioning Community integration	Multivariate Catastrophizing (-) accounted for unique variance in pain, physical functioning, and community integration. Univariate Catastrophizing (-) significantly associated with pain, physical functioning, and community integration.
Whyte and Carroll, 2004 <sup>44</sup> ; Cross-sectional correlational design; N=315 (acquired amputation)	Catastrophizing	Physical functioning Psychological functioning	Multivariate analyses Catastrophizing accounted for unique variance in physical functioning and psychological functioning (note: the direction of the association found is not clear, but a reasonable hypothesis would be that more catastrophizing is associated with more dysfunction, given the findings from other studies).

Author, Year; Study Design; Total Sample Size	Psychosocial Domains Measured	Criterion Variables	Primary Findings
Widerström-Noga et al, 2006 <sup>45</sup> ; Cross-sectional correlational design; N=161 (SCI)	Beliefs Social	Physical functioning Psychological functioning	Multivariate analyses Solicitous social responses (+) accounted for unique variance in psychological functioning. Univariate analyses Life control beliefs (+) significantly associated with psychological functioning (note: this finding is listed as a univariate analysis because life control was entered in the first step of a regression analysis).
Williams et al, 2004 <sup>46</sup> ; Cross-sectional correlational and prospective predictive study; N=89 (acquired amputation)	Social	Physical functioning Psychological functioning	Multivariate analyses Social support (+) accounted for unique variance in physical and psychological functioning. Social support (+) assessed at 1-mo postamputation accounted for unique variance in subsequent change in physical and psychological functioning over the next 6mo.
Wollaars et al, 2007 <sup>47</sup> ; Cross-sectional correlational design; N=215 (SCI)	Catastrophizing Coping Beliefs	Physical functioning Psychological functioning Perceived general health	Multivariate analyses Catastrophizing (-) accounted for unique variance in psychological functioning and perceived general health. Acceptance coping (+) accounted for unique variance in psychological functioning. External pain control beliefs (+) accounts for unique variance in psychological functioning. Univariate analyses Catastrophizing (-), helplessness beliefs (-), and acceptance coping (+) significantly associated with physical functioning, psychological functioning, and perceived general health. Disease benefits beliefs (+) significantly associated psychological functioning and perceived general health. Internal pain control beliefs (+) significantly associated with psychological functioning and physical functioning. External pain control beliefs (-) significantly associated with physical functioning and psychological functioning.

\* The direction of the relationship between the psychosocial predictors and criterion measures is indicated as a "+" or "-" in parentheses after each psychosocial factor in the Primary Findings column. However, the measures used to assess the criterion variables in these studies are sometimes scored such that higher scores indicate better functioning (eg, perceived well being as measure of psychological functioning), and sometimes scored such that higher scores indicate poorer functioning (eg, depression as a measure of psychological functioning). Thus, the signs (+ or -) do not indicate the direction of the relationship with respect to the specific measure used. Rather, the direction of the sign indicates the direction of the relationship, such that a "+" indicates that higher scores on the psychosocial predictor are associated with better functioning (eg, less pain intensity, less depression, more well being, less pain interference, more community integration, etc.), and a "-" indicates that higher scores on the psychosocial predictor are associated with poorer functioning (eg, more pain, more anxiety, less activity, etc.). Taking into account the standard qualifications regarding causality (see text), a "+" reflects the possibility that the psychosocial factor may tend to be more adaptive, and a "-" reflects the possibility that the psychosocial factors may tend to be more maladaptive.