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Pain Interference in Persons With Spinal Cord Injury: Classification of Mild, Moderate, and Severe Pain

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Abstract: **Pain intensity is commonly measured by patient ratings on numerical rating scales (NRS). However, grouping such ratings into categories may be useful for guiding treatment decisions or interpreting clinical trial outcomes. The purpose of this study was to examine pain intensity classification in 2 samples of persons with spinal cord injuries (SCI) and chronic pain. The first sample (n = 307) rated the average intensity and activity interference of pain in general, and the second sample (n = 174) rated their worst pain problem. Pain intensity was categorized as mild, moderate, or severe using 4 possible classification systems; analyses were performed to determine the classification system that best distinguished the pain intensity groups in terms of activity interference. In both samples, the optimal mild/moderate boundary was lower (mild = 1-3 on a 0-10 NRS scale) than that reported previously for individuals with other pain problems. The possibility that pain may interfere with activity at lower levels for individuals with SCI requires further exploration. The moderate/severe boundary suggested by previous research was confirmed in only one of the samples. Implications for the assessment of pain intensity and functioning in persons with SCI and pain are discussed.**

Perspective: ***Although pain in individuals with SCI is common, more research is needed regarding its characteristics and treatment. This study sought to develop an empirically based classification system for mild, moderate, and severe pain that could be useful for applying clinical treatment guidelines and for interpreting the results of much-needed clinical trials.***

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Key words: *Spinal cord injury, pain interference, severity, classification.*

Pain intensity is the most frequently assessed outcome variable in pain research. It is often quantified using numerical rating scales (NRS), such as 0 to 10 or 0 to 100 scales. Although these scales are useful for measuring changes in pain over time or correlating pain intensity with other variables,[11] categorical pain scales (eg, none, mild, moderate, severe) may provide information that is valuable for other purposes,[1] such as helping to guide treatment decisions.[6] For example, the Agency for Health Care Policy and Research[9] and the World Health Organization[33,34] provide clinical practice guidelines for mild, moderate, and severe pain. However, these practice guidelines do not yet include clear standards for how to classify pain ratings into these categories. Therefore, empirically derived standards for pain classification could assist in applying these clinical guidelines and in evaluating treatment outcomes. In addition, these common terms may be useful in clinical settings when health care providers and patients discuss pain.[1]

Chronic pain is a frequent secondary problem in persons with spinal cord injuries (SCI)[2-5,7] and can cause ad-

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ditional disability[18,26,30,31] and interference with functioning[7,14,16,19,23,25,26,31] beyond that caused by the SCI itself. For example, 77% of a sample of patients with SCI-related pain reported that pain interfered with 1 or more daily activities, such as sleep, work, exercise, and household chores.[31] Another study surveying members of an SCI self-help association found that a substantial number of those who were unemployed reported that pain, rather than paralysis, prevented them from working, and 83% of those who were employed reported that pain interfered with their work.[19]

However, although preliminary research has determined that pain is an important issue for individuals with SCI, more research is needed regarding its prevalence, causes, characteristics, and treatment.[26] Several studies of pain in individuals with SCI have examined pain interference in relation to psychosocial variables[18,23,31] using terms such as distressing,[23] severe,[12] and excruciating.[22] Without clear definitions of these terms, this body of research can be difficult to interpret. A standardized classification system for pain severity may also help to interpret findings across studies and to determine the relative impact of different types of pain (eg, neurogenic vs musculoskeletal) or pain sites (eg, shoulder pain). Additionally, pain severity categories may help to support the clinical meaningfulness of changes in pain during treatment, and to pinpoint types of pain that are more responsive to treatment.

One way to classify pain intensity is in terms of its interference with daily activities. In contrast to previous approaches integrating psychosocial or behavioral measures of pain impact,[24,29] Serlin and colleagues[20] used a straightforward empirical approach to classify cancer pain into categories of mild, moderate, and severe pain in terms of its association with functioning. Their results indicated that a 1-4, 5-6, and 7-10 classification of mild, moderate, and severe cancer pain provided the optimal cutoffs across these samples. This empirical approach has since been applied in studies of individuals with various other pain problems.[10,15,17,27,35]

The purpose of this study was to examine the association between pain severity and pain interference in the SCI population using the empirical method described by Serlin and colleagues. Our objectives were to determine: (1) the classifications of pain intensity that best distinguish mild, moderate, and severe pain in individuals with SCI, (2) whether similar optimal cutpoints would be found for ratings of pain in general as for ratings of an individual's worst pain problem, and (3) whether the optimal classifications would be consistent with the cutpoints identified in other pain problems.[10,15,20,27]

Materials and Methods

Sample

The data for this report came from a study of pain in persons with SCI.[26,28] Study participants were recruited through an SCI mailing list and newsletter, and notices placed in clinics and other facilities that serve people with SCI. Individuals who expressed interest in participating were mailed questionnaires. Study inclusion criteria were SCI of at least 6 months duration and age 18 years or older. Participants were paid $20 for completing and returning the questionnaire. The University of Washington Human Subjects Review Committee approved the study questionnaires and protocol, and all participants provided written informed consent. The original questionnaire was modified after completion by approximately 300 participants (wave 1), in order for the results from the first questionnaire to be extended and cross-validated.

For the present report, we analyzed data from the 307 wave 1 and the 174 wave 2 (modified questionnaire) respondents who reported a current pain problem (79% of wave 1 and 76% of wave 2 participants). Details of response rates, sociodemographic characteristics, and pain and injury characteristics of the 2 samples were reported previously.[26,28] In brief, the mean age in the wave 1 sample was 43.1 (SD = 13.0; range = 19-84) years and the mean age in the wave 2 sample was 41.6 (SD = 13.6; range = 18-77) years. Both samples were predominantly male (72% in wave 1, 71% in wave 2) and Caucasian (84% in wave 1, 85% in wave 2). The majority of participants in both samples had completed at least some college education (70% in wave 1, 64% in wave 2).

Measures

Demographic Information

Participants from both samples were asked to answer questions about their sociodemographic characteristics, injury characteristics, and any pain experienced since their spinal cord injury.

Pain Presence/Absence and Pain Intensity

Participants in both wave 1 and wave 2 were asked if they were currently experiencing any pain problem. Participants in wave 1 reporting current pain (n = 307) were then asked to rate their average pain over the last 3 months on a 0 to 10 NRS, where 0 = "no pain" and 10 = "pain as bad as could be."[29] Because the survey asked about "pain" without any further descriptors, we assume that the wave 1 participants were rating their overall pain. Participants in wave 2 with current pain (n = 174), however, were first asked to identify the location of their worst pain problem, and then to rate the average intensity of this specific pain problem over the last 3 months on the 0 to 10 NRS.

Pain Interference

For both samples, participants were also asked to rate, on a 0 to 10 NRS, the extent to which pain interfered with daily activities during the past 3 months, where 0 = "no interference" and 10 = "unable to carry on any activities."[29] On wave 1 questionnaires, participants based ratings of interference on pain in general. On wave 2 questionnaires, participants rated the extent to which their worst pain problem interfered with activities.

Table 1. Mean (M) Pain Interference at Each Level of Pain Intensity (Intensity of Overall Pain for Wave 1 Sample and Intensity of Worst Pain Problem for Wave 2 Sample)

	Pain Interference			
	Wave 1 (n = 305)		Wave 2 (n = 172)	
Pain Intensity	M (SD)	n	M (SD)	n
1	.56 (.73)	9	1.00 (.82)	4
2	1.50 (1.61)	20	2.75 (2.55)	8
3	2.39 (1.95)	41	2.26 (1.70)	19
4	3.37 (2.70)	38	3.91 (2.43)	34
5	4.03 (2.75)	61	3.89 (2.60)	37
6	4.18 (2.34)	50	5.04 (3.11)	23
7	5.03 (2.94)	33	6.00 (2.26)	17
8	5.50 (3.62)	24	6.85 (1.35)	13
9	6.90 (2.23)	10	6.25 (3.86)	4
10	7.95 (2.15)	19	6.08 (4.01)	13

NOTE. Two participants in each sample had incomplete data and are not included in this table.

Data Analysis

We used the statistical method described by Serlin et al[20] and applied in other investigations of this issue,[10,15,27,35] to determine the optimal boundaries for mild, moderate, and severe pain. We classified each participant's pain intensity rating on the 0 to 10 NRS as mild, moderate, or severe using 4 different classification schemes, named for the upper values in the mild and moderate categories: cutpoints (CP) 3,6 classified mild = 1-3, moderate = 4-6, and severe = 7-10; CP 3,7 classified mild = 1-3, moderate = 4-7, severe = 8-10; CP 4,7 classified mild = 1-4, moderate = 5-7, and severe = 8-10; and CP 4,6 classified mild = 1-4, moderate = 5-6, and severe = 7-10. In order to determine which classification scheme was best able to distinguish between mild, moderate, and severe pain, we conducted an analysis of variance (ANOVA) for each of the 4 classification schemes, separately for both samples, using group (mild, moderate, or severe) as the independent variable and pain interference as the dependent variable. A significant *F* value indicated that there were significant differences between the 3 pain severity groups on pain interference, and we interpreted the highest *F* value as indicating the classification scheme that maximized the differences between the groups and therefore was most useful for distinguishing mild, moderate, and severe pain.

To examine whether differences found between samples in optimal pain intensity classification schemes might reflect sample differences other than type of pain rated, we also compared the 2 samples using *t* tests for continuous and ordinal variables (eg, age, pain intensity, and interference) and Pearson χ^2 analyses for categorical variables (eg, gender, race, education level, marital status, cause of injury, and level of injury).

Results

The mean pain intensity on the 0-10 NRS was 5.33 (SD = 2.25) for wave 1 and 5.35 (SD = 2.24) for wave 2; the mean pain interference was 4.05 (SD = 3.00) for wave 1 and 4.39 (SD = 2.90) for wave 2. The mean number of pain locations was 3.30 (out of 7 possible locations; SD = 1.70) for wave 1 and 3.67 (out of 15 possible locations; SD = 2.11) for wave 2. Most participants in both samples reported pain in more than 1 location, most commonly the back, buttocks/hips, and legs/feet. More detailed information regarding pain in these samples has been reported previously.[26,28]

The means and standard deviations for pain interference for wave 1 and wave 2 subjects at each pain intensity rating are presented in Table 1. The optimal classification scheme was inconsistent across samples (Table 2). The optimal pain severity classification scheme (based on the highest *F* value) for the wave 1 sample (pain in general) was CP 3,7 (1-3, 4-7, and 8-10). Using this scheme, 23% (n = 71), 60% (n = 183), and 17% (n = 53) had mild, moderate, and severe pain, respectively. The optimal pain severity classification for the wave 2 sample (worst pain problem) was CP 3,6 (1-3, 4-6, and 7-10). Using this classification scheme, 19% (n = 32), 54% (n = 94), and 27% (n = 47) had mild, moderate, and severe pain, respectively.

There were no significant differences between the samples in either demographic variables (age, gender, race, education level, marital status) or SCI-related variables (cause and level of injury). Similarly, neither pain intensity nor pain interference differed significantly between samples. Owing to sample size restrictions, it was not possible to test the consistency of the optimal classification scheme across subgroups of these samples, although we determined that the optimal cutpoints did not change after controlling for demographic or SCI variables.

Discussion

In this study, we sought to determine the optimal scheme for categorizing pain intensity ratings of individuals with SCI by applying the empirical method first used by Serlin and colleagues.[20] The boundary between mild and moderate (3 = highest level of mild) was consistent across the 2 SCI samples but lower than that identified in previous research with other types of pain.[10,15,17,27,35]

Table 2. Comparison of 4 Different Systems for Classifying Pain Intensity Ratings as Mild, Moderate, or Severe Based on Activity Interference: *F* Ratios of ANOVAs

Pain Type	CP 3,6	CP 3,7	CP 4,7	CP 4,6
Wave 1 (n = 307), pain in general	48.33	50.18	47.63	44.73
Wave 2 (n = 174), worst pain problem	23.70	19.50	16.79	19.80

The boundary between moderate and severe differed across the 2 SCI samples.

One of our SCI samples was asked to rate pain in general, whereas the other SCI sample rated their "worst" pain problem. Other than the manner in which pain was assessed, procedures were the same for both samples, and there were no significant differences between the 2 samples in the demographic, SCI-related, or pain-related variables assessed. An upper limit of 3 for mild pain was consistent for both samples. However, the optimal cutpoint for moderate pain was 7 for the sample rating pain in general and 6 for the sample rating their worst pain problem. Given that CP 3,6 provided the second highest *F* value for wave 2, it is possible that either 6 or 7 could be used as an optimal cutpoint for pain in SCI. Given the sample size, random error is another possible explanation for the difference in cutoffs identified in the 2 samples. Our results suggest that pain intensity of 8-10 will generally be associated with substantial pain-related activity interference, and that 7 will sometimes be associated with a high level of pain-related activity interference. Whether a particular person rating a pain level as 7 or 8 considers the pain as having a severe impact on function may depend on a number of variables, such as pain location or type of pain problem. It is also possible that the optimal classification scheme may vary according to the manner in which pain is assessed, given that slightly different cognitive tasks are required based on the wording of the assessment question.[8] Future research may benefit from assessing both "pain in general" and the "worst pain" problem as well as from identifying the specific nature and characteristics of the pain problem(s) of interest.

It is also possible that the cutpoints identified in the current study may not be optimal for all types of pain in SCI, or that other variables, in addition to pain intensity, may be associated with pain interference. Although there is no current consensus regarding the classification of SCI-related pain into distinct types,[3] efforts are underway to develop standardized categories for types of pain in this population.[4,5,13,21] A standardized scheme for classifying pain into categories of mild, moderate, and severe may help to determine whether certain types or locations of pain in individuals with SCI are particularly problematic in terms of interference with daily activities. Given the inadequacy of available treatment modalities for SCI-related pain[32] and the need for further research on effective treatments,[3] these severity categories may also aid interpretation of clinical trials. Interventions may be deemed successful, for example, if they decrease pain intensity from severe to mild or moderate interference with functioning, even if they do not completely eliminate pain.

The optimal classification scheme in these samples of individuals with SCI and pain was not fully consistent with past research with other pain populations. The optimal classification scheme has been reported to be 1-4, 5-6, and 7-10 (CP 4,6) for cancer pain,[20] low back pain,[27] and acute postoperative pain.[15] Jensen and colleagues[10] also found some support for this classification scheme for pain in amputation samples, given that it was the best or second best for each type of pain (phantom limb, residual limb, and back pain) assessed. In the current study, an upper limit of 3 for mild pain was supported in both samples, raising the possibility that pain in SCI may begin to have a noticeable impact on functioning at a lower level of pain intensity, compared to other pain problems. Pain in SCI, even at "lower" levels, may exacerbate the significant functional limitations that may be present for persons with SCI. Future research could test this hypothesis by comparing pain interference at each level of pain intensity between individuals with SCI and individuals without SCI.

Regarding the moderate/severe cutpoint, an upper boundary of 7 for moderate pain was supported for the sample that rated pain in general, whereas an upper boundary of 6 was supported for the sample that rated their worst pain problem. A cutpoint of either 6[10,20,27] or 7[10,17] has been supported for different samples of individuals with pain, or even for different assessment days within the same sample.[15] Although consistency across pain problems would be helpful, perhaps we should not over-interpret the differences reported across such samples. The consistent finding in all of these studies, including the current one, is that pain intensity in the range of 1-3 has been classified as mild based on association with functioning, 5-6 as moderate, and 8-10 as severe. Less consistent are findings for pain rated as 4 and 7. Pain intensity of 4 sometimes tends to be grouped with lower pain ratings ("mild" activity interference) in terms of association with functioning and sometimes with higher pain ratings ("moderate" activity interference). Pain intensity of 7 is sometimes grouped with lower ("moderate" activity interference) and sometimes with higher ("severe" activity interference) pain ratings. The method developed by Serlin et al[20] addresses an important practical problem by providing an empirical basis for categorizing pain as mild, moderate, or severe; however, the optimal classification scheme may vary depending on the reference measure of function and the nature of the sample.

We acknowledge several study limitations. First, the samples from which these subsamples (those with current pain) were derived, with response rates of 64% and 61%, represent only a portion of individuals with SCI, and we do not know if the results would have differed if all potential participants had responded. Also, given the survey design of the study, it was not possible to classify types of pain associated with SCI (eg, neurogenic vs musculoskeletal) or to compare responses to objective medical data. Our understanding of pain in SCI may benefit from research examining which types or locations of pain are associated with the greatest interference with function.

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