



Published in final edited form as:

*Pain Med.* 2011 April ; 12(4): 612–617. doi:10.1111/j.1526-4637.2011.01072.x.

## Development and Preliminary Psychometric Testing of the Centrality of Pain Scale

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### Abstract

**Objective**—To develop and begin to evaluate a new measure of the centrality of pain in patients' lives.

**Design**—Cross-sectional survey and cognitive interviews.

**Setting**—Academic general internal medicine clinic.

**Patients**—65 adult internal medicine patients with chronic non-malignant pain (CNMP).

**Outcome measures**—We assessed content validity and clarity of the 10-item Centrality of Pain Scale (COPS) by soliciting feedback from chronic pain experts and by conducting cognitive interviews with patients with CNMP. We assessed internal consistency reliability using Cronbach's alpha. We assessed construct validity by comparing the COPS with other measures of chronic pain morbidity including pain severity, depression, anxiety, physical and mental health function, PTSD, quality of life, and provider assessment.

**Results**—Healthcare providers felt the COPS had excellent face validity. Cognitive interviews revealed that patients' understanding of the items matched the intended construct, the scale measured an important concept, and items were easy to understand. The COPS had excellent internal consistency ( $\alpha=0.9$ ). COPS was negatively associated with age ( $r=-0.29$ ;  $p=0.02$ ), but not with other demographic characteristics. Higher COPS scores were associated with poorer physical ( $r=-0.48$ ;  $p<0.001$ ) and mental ( $r=-0.39$ ;  $p=0.002$ ) health function, quality of life ( $r=-0.36$ ;  $P=0.004$ ) and provider assessment of stability ( $r=-0.38$ ;  $p=0.004$ ) as well as with greater pain grade ( $r=0.55$ ;  $p<0.001$ ) and depression ( $r=0.63$ ;  $p<0.001$ ). In multivariate analyses, age, physical and mental health function, and depression were independently associated with COPS.

**Conclusions**—The COPS has excellent internal consistency and construct validity. Additional studies are needed to further validate the scale.

### Keywords

Chronic pain; quality of life; health function

## Introduction

Chronic non-malignant pain is an extremely common and challenging problem in primary care.<sup>1</sup> Inadequate assessment of chronic pain has been identified as a key barrier to chronic pain management.<sup>2</sup> Several well-validated instruments exist to measure pain outcomes.<sup>3,4</sup> For example, instruments such as the Graded Chronic Pain Scale,<sup>5, 6</sup> the Brief Pain Inventory,<sup>7</sup> and the Multidimensional Pain Inventory<sup>8</sup> adequately assess pain intensity, pain-related disability, and interference with activities. Many authors have also suggested systematically measuring emotional health or co-morbid mental illness in patients with non-malignant pain<sup>3, 4</sup> with measures such as the Beck Depression Inventory<sup>9</sup> or the depression scale of the Patient Health Questionnaire (PHQ-9).<sup>10, 11</sup> Moreover, a large number of instruments exist to measure psychological factors that could potentially influence how a patient experiences pain. Examples include the Survey of Pain Attitudes (SOPA)<sup>12</sup> and measures of pain catastrophizing.<sup>13</sup> However, these measures may not fully capture the effectiveness of chronic pain management.

Our clinical experience suggests that it is important to understand how “central” chronic pain is to a patient’s life: that is, how much pain dominates or “takes over” a patient’s life. The concept of measuring the “centrality” of pain emerged over several years while the one of the authors (CN) was supervising a chronic pain practice within an academic internal medicine clinic. Conversations with patients focused on what was different when their pain was or was not well controlled. Conversations with primary care providers and chronic pain specialists focused on what discriminated between patients with good or poor pain control and what changed when providers were successful in helping patients manage their pain.

Both patients and providers often felt that current measures of pain intensity, disability, and interference did not adequately capture what was most important clinically. Furthermore, while they acknowledged that function was important, they often felt that it was not always a good measure of the success of pain management, especially in patients with co-morbid chronic conditions. For example, some patients with very limited function or high pain severity scores felt that they had good pain control, while others felt their pain was extremely out of control even though they had fewer functional limitations or rated their pain severity using a lower number on a 0 to 10 scale. Similarly, patients generally underscored the importance of how much pain interfered with activities, but they did not feel it fully captured the impact of pain on their lives. For example, a patient might be able to continue his or her usual activities, but may feel that pain still dominated his or her thoughts or life to an unacceptable degree. A key unmeasured element of pain control emerged - how “central” is the pain to the patient’s life. Both providers and patients often felt that successful pain control was defined not by reducing the severity of pain, but by reducing the “centrality” of the pain so that it no longer dominated their thoughts or activities.

Our aim was to develop and psychometrically evaluate an instrument that would measure the centrality of pain. Such an instrument may be useful both as an outcome measure and as a clinical tool to guide discussions about goals and expectations for pain management. We use the term “Centrality of Pain” as a patient-centered concept related to how “central” pain is to a patient’s life. It is not to be confused with biological phenomenon of pain centralization, in which normally non-painful stimulation is perceived as pain due to an alteration in the way such stimuli is processed in the brain and spinal cord.<sup>14, 15</sup>

## Methods

### Setting

This study was conducted with patients seen in a chronic pain practice within an academic general internal medicine clinic. The practice was supervised by 2 general internal medicine attending physicians. Internal medicine residents saw patients in the clinic as part of their Chronic Illness Management rotation. All of the residents' patients who were using opioids for chronic non-malignant pain were assessed at least once in the chronic pain practice. Faculty could also refer their patients to the practice if they desired additional support in managing their chronic pain. Patients with complex needs were seen regularly in the chronic pain practice, while patients with very stable needs were sent back to their primary care providers for further opioid prescribing. The program kept a registry of primary care patients on opioids for chronic non-malignant pain. A majority of patients in this practice suffered from fibromyalgia, chronic back pain, osteoarthritis, chronic abdominal pain, or medically unexplained chronic pain and had experience pain for over a year.

The Oregon Health & Science University Institutional Review Board approved this study. We obtained written informed consent from all participants.

### Preliminary Scale Development

The principal investigator (PI) (CN) identified key concepts based on clinical experience and discussions with patients and colleagues to create a preliminary version of the Centrality of Pain Scale. She shared early versions of the scale with the members of the Chronic Pain Interest Group of the Society of General Internal Medicine, as well as with local colleagues and patients. The scale was revised based on this feedback and included 10 items in the initial item pool (Table 1.) After the completion of the cognitive interviewing, an expert in chronic pain management suggested two additional items. The last 47 patients thus completed a 12 item scale. However, these two items are not included in the final scale as there was little variation in response to those items and no data on those items from the cognitive interviews.

### Recruitment and data collection

All patients presenting to the General Internal Medicine Chronic Pain Clinic over a two month period were offered a flyer about the study. A co-investigator (TC) approached patients, described the study, and obtained written informed consent. Participants were asked to complete the survey, on paper, while in the clinic. After completing the survey, the first 18 participants also took part in an in-person cognitive interview about the Centrality of Pain Scale. At the end of the visit, the provider who saw the patient that day in pain clinic was asked to complete a three-item paper questionnaire about the patient's pain control.

At the end of this two-month period, we mailed a letter, consent form, and copy of the survey to all remaining active patients in the chronic pain registry. These patients had been seen in the chronic pain practice within the past year *or* had been seen in the chronic pain practice prior to the last year and were receiving pain management services from their primary care provider in our general internal medicine clinic. A co-investigator (TC) called participants who had not returned the mailed survey and reminded them to do so. Once we received completed surveys and consent forms from participants, we contacted their primary care providers to ask them to complete the three-item assessment of the patient's pain control. Participants were offered \$5 for completing the survey and, if applicable, an additional \$5 for participating in a cognitive interview.

## Cognitive interviewing

We used the technique of cognitive interviewing<sup>16</sup> to assess construct validity. Cognitive interviewing has become a standard method for evaluating the language and clarity of survey items as well as providing evidence for the content validity of our measure. Testing survey items with the intended audience can reveal situations where respondents do not have the information needed to answer a question, where terms used are unclear or ambiguous, or where respondents' understanding of an item does not align with the construct the investigator is trying to capture. Cognitive interviews followed a structured interview guide, developed under the guidance of a measurement expert (MG). Topics included: 1) whether or not each item was easy to understand and, if not, how it could be improved; 2) the participants' impression of what the scale was trying to measure; 3) examples of what the participant meant when he or she responded to the items; 4) whether or not the participant felt the scale was measuring something that was important; 5) whether the items were measuring one concept or different concepts; and 6) whether there were other important aspects of pain or pain control that we should be asking about. The co-investigator took detailed notes during the cognitive interviews and discussed them with the PI.

## Construct Validity

In addition to the new Centrality of Pain Scale, the patient survey included a number of previously validated measures of constructs that we hypothesized would be associated with the centrality of pain in patients' lives. We used the Chronic Graded Pain Scale (CGPS)<sup>5</sup>, 6 to measure pain intensity and interference, the depression scale of the Patient Health Questionnaire (PHQ-9)<sup>10</sup>, 11 to measure depression, the stem questions about generalized anxiety disorder and panic disorder from the Patient Health Questionnaire<sup>17</sup>, 18 to screen for possible anxiety and panic disorders, the Short Form 12 (SF-12)<sup>19</sup> to measure physical and mental health function, the Veterans Administration Post Traumatic Stress Disorder (PTSD) checklist – civilian version<sup>20</sup> to assess PTSD, and a single-item rating quality of life on a scale of 1 to 10. Patient surveys also included demographic information, items on lifetime experiences of child abuse, intimate partner violence, and community violence, and items on satisfaction with the care. Provider surveys asked three items about how well the patient's pain was controlled, the stability of the patient's pain management, and how much the pain was consuming the patient's life. Response options for each item were on a 5-point Likert scale, with higher scores indicating greater pain control, stability of pain management, and focus on pain in the patient's life.

## Data Analysis

We used Cronbach's alpha to assess internal consistency reliability. We calculated the Centrality of Pain Score by reverse coding items 2, 4, and 9 and totaling the score of all 10 items, so that a higher score corresponds to pain being more central to the patient's life. To assess convergent validity, we compared the Centrality of Pain Score to other self-report measures of pain, mental health, and function described above, as well as to provider's assessment of the patient's pain control. We used Pearson's Correlation to assess congruence between COPS and with measures that had continuous scores. We used unpaired t-tests to assess the association between measures with dichotomous outcomes and COPS score. We also created a linear regression model with COPS score as the dependent variable. Independent variables included all available measures of pain, physical, and mental health outcomes, as well as demographic characteristics found to be associated with COP score at a level of  $p < 0.1$ .

## Results

### Participants

Sixty five of 112 patients (58%) in the chronic pain registry completed the survey. Response rate was significantly higher for patients who were recruited in person vs. by mail (78% vs. 33%). Mean age was 53 (range 25–77). A majority (65%) were female. As is typical for our clinic population, the vast majority (82%) were white, non-Hispanic. A majority (62%) were disabled, with only 19% employed full or part-time and the remainder unemployed (8%) or retired (12%). Almost all (91%) had completed high school, with 47% also completing college. A majority (59%) had an annual household income of less than \$15,000.

### Cognitive Interviewing

We conducted cognitive interviews with the first 18 participants. Participants noted that items were easy to understand. Participants' own descriptions of what the items were trying to measure closely matched the intended construct. They felt that the scale was measuring a single construct that was extremely important and was not captured well by the other measures in the survey.

Based on feedback from 4 participants, we adjusted the wording of one item to increase clarity. (The phrase “most of the time” was added to the statement “I have control over my pain”.) The change was felt to be minor, so results are presented together for participants completing the two versions.

### Centrality of Pain Scale

The final Centrality of Pain Scale has 10 items (Table 1). Responses are measured on a 5-point Likert Scale with anchors of Strongly Disagree to Strongly Agree. There was adequate variability in response to all 10 items, with responses ranging from 1 to 5 on each item. Scale scores are calculated by summing all 10 items and can range from 10 to 50. Scores in our sample ranged from 13 to 49, with a mean of 31.8, a median of 32, and a standard deviation of 8.3. The scale showed excellent internal reliability with a Cronbach's alpha of 0.9. Scores followed a normal distribution without being significantly skewed in either direction (skewness: - 0.11; std: 0.30).

### Construct validity

Centrality of Pain Score was positively correlated with chronic pain grade (including chronic pain grade intensity and disability scores and the item on pain interference), severity of depressive symptoms and provider assessment of how much pain was consuming the patient's life.

Centrality of Pain score was negatively correlated with physical health function, mental health function, quality of life, and provider assessment of pain control. Centrality of pain score had a slightly weaker association with provider assessment of stability, which did not reach statistic significance ( $p=0.08$ ). (Table 2). Patients who screened positive for depression, PTSD, anxiety or panic disorder had higher Centrality of Pain Scores than patients who did not (Table 3).

Centrality of Pain score was not associated with gender, race, employment, education, or income. Centrality of Pain score was negatively associated with age, that is, younger patients felt that pain was more central to their lives than older patients ( $r=-0.29$ ;  $p=0.02$ ). There was no association between Centrality of Pain score and lifetime experiences with violence victimization. In multivariate analyses, Centrality of Pain Score was independently

associated with age, depressive symptoms, and mental and physical health function (Table 4).

## Discussion

The concept of the Centrality of Pain as a measure of patients' pain control emerged from years of informal discussions with patients with chronic non-malignant pain, pain experts, and primary care providers. Theoretically, the patient's experience of pain can be influenced by many factors: the underlying physical condition causing the pain, co-morbid physical or mental health problems, personality traits, attitudes, social stressors, and supports, substance abuse, lifetime experiences of violence or abuse, and use of medications and other therapies. The Centrality of Pain Scale is intended to measure the overall effect of these various factors on the patient's own perception of how much pain is dominating his or her life. It is not intended as a judgment about any specific underlying factor contributing to the patient's experience of pain.

Cognitive interviews with primary care patients on opioid therapy for chronic non-malignant pain confirm that the items in the COPS are easy to understand and that the scale measures a clear construct that patients feel is important to them and is not well-captured by standard measures of pain or health function. Preliminary psychometric testing indicates that the scale has excellent internal consistency and support for construct validity. Patients' scores on the Centrality of Pain Scale are correlated in the expected directions with other self-report measures of pain severity, mental illness, quality of life, physical and mental health function, as well as with providers' assessments of pain control. Interestingly, Centrality of Pain Scores appear to be higher in younger patients than older patients. This result is consistent with our clinical perception that younger patients with chronic pain often appear to be more distressed and consumed by pain than their older counterparts, potentially due to a cohort effect or age-related differences in expectations, roles, and responsibilities.

We recognize this is a preliminary study of a newly defined construct. As such, it has multiple limitations, including its small size, relatively low response rate, and cross-sectional study design. Clearly, other studies will be needed to further assess the reliability and validity of the COPS. In addition, generalizability may be limited, especially to patients who are not on chronic opioid therapy, to patients with higher incomes or lower degree of disability, and to patients from racial or ethnic minority populations.

However, our study provides important preliminary data supporting the reliability and validity of an easy to use measure of a construct not included in most pain scales. In our own clinical experience, we have used the concept of the Centrality of Pain as a basis for clinical discussions around pain management goals and expectations, as well as to discuss how well pain management strategies are working. Future studies of the psychometric properties of the COPS should include exploratory or confirmatory factor analyses to verify the factor structure of the construct, as well as validating the measure in other populations, and assessing its test retest reliability and responsiveness to change. Future studies also need to assess different modalities for administering the scale, examine its relationship to patient expectations and outcomes, and its usefulness in clinical practice.

## Acknowledgments

This study was funded by the Oregon Health & Science University Division of General Internal Medicine and Geriatrics. The study would not have been possible without the support of Judith L. Bowen, who was serving as the Division Chief at the time the study was being conducted. We would like to thank Ruth Liebowitz, PhD, for help in conceptualizing the Centrality of Pain Scale and the members of the Society of General Internal Medicine Chronic Pain Interest Group, Erik Fromme, MD, MPH, and Ben Morasco, PhD for reviewing early versions of the scale. We



wish to thank medical assistants Cecilia Afleje, Hope Roach, and Tony Thao for their help in incorporating the study into a busy clinical practice. We would also like to acknowledge Ana Hilde and Angie Mejia for administrative support. Dr. Nicolaidis' time was supported, in part, via a career development award from the National Institute of Mental Health (K23MH073008).

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### The Centrality of Pain Scale

Please rate how strongly you agree or disagree with each of these statements about your chronic pain on your current pain regimen. Think about how your pain has affected your life over the past month.

Table 1

Item*	Mean	SD	Median	Range
1. Pain controls my life.	3.74	1.15	4	1-5
2. I am able to live a full life despite my pain.**	3.46	1.19	4	1-5
3. My pain defines who I am.	2.37	1.13	2	1-5
4. I have control over my pain most of the time.**	3.25	1.19	3	1-5
5. I think about pain all the time.	2.92	1.1	3	1-5
6. My pain consumes all of my energy.	2.97	1.15	3	1-5
7. My life revolves around my pain.	2.95	1.33	3	1-5
8. Pain is a constant struggle for me.	3.74	1.06	4	1-5
9. I can deal with my pain.**	2.82	1.12	3	1-5
10. Pain greatly interferes with my life.	3.60	1.13	4	1-5
Scale Score	31.82	8.35	32	13-49

\* All items are rated on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, and 5=strongly agree.

\*\* Reverse scored.

**Table 2**

Association between Centrality of Pain Score and measures with continuous outcomes

Measure	Correlation Coefficient	p-value
Graded Chronic Pain Grade (GCPG)	0.549	<0.001
GCPG – Intensity score	0.499	<0.001
GCPG – Disability score	0.594	<0.001
GCPG – interference item	0.652	<0.001
SF12 Physical Composite Score	-0.483	<0.001
SF12 Mental Composite Score	-0.385	0.002
PHQ 9 (depressive symptoms)	0.627	<0.001
Quality of Life	-0.357	0.004
Provider assessment of pain control	-0.418	0.002
Provider assessment of stability of pain management	-0.244	0.078
Provider assessment of how much pain is consuming patient's life	0.399	0.003

**Table 3**

Association between Centrality of Pain Score and measures with dichotomous outcomes

Measure	Groups	N	Mean COP score	SD	T-value	Effect Size	P value
PHQ9	<10	38	28.8	7.04	-4.01	0.21	<0.0001
	>=10	25	36.6	8.33			
Anxiety	No	20	25.6	8.06	-4.52	0.26	0.0002
	Yes	41	34.7	7.08			
Panic	No	36	28.4	7.91	-4.03	0.22	0.0002
	Yes	25	36.4	7.16			
PTSD	No	45	29.9	7.90	-2.88	0.12	0.005
	Yes	16	36.7	8.47			

**Table 4**

Independent associations with Centrality of Pain Score

<b>Independent Variable *</b>	<b>Beta</b>	<b>P-value</b>
Age (continuous)	-0.228	0.039
PHQ-9	0.402	0.007
SF12 – PCS	-0.415	0.002
SF12- MCS	-0.341	0.022
Pain Grade	0.224	0.070
Panic	0.203	0.080
PTSD	-0.217	0.089

\* Also adjusted for quality of life, anxiety, and provider assessment score, none of which were statistically significant,  $p > 0.4$ .