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Linking Report

Linking the Pain Catastrophizing Scale (PCS) to the University of Washington Concerns About Pain (UW-CAP) Scale v1.0

(Formerly called Pain Appraisal Scale or UW-PAS)

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Questions about the UW-CAP Instruments

If you have questions about the UW-CAP instruments or their use in clinical care or research, please contact the University of Washington Center on Outcomes Research in Rehabilitation (UWCORR).

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Overview of Linking Approach

Measures Linked

Pain Catastrophizing Scale (PCS): The PCS was developed by Sullivan et al. in 1995 as "an effort to develop a comprehensive evaluation instrument that would encompass the different perspectives on catastrophizing." (see *Sullivan MJL, Bishop S, Pivik J. The Pain Catastrophizing Scale: Development and validation. Psychol Assess 1995, 7: 524-532*.) The authors define catastrophizing as "an exaggerated negative mental set brought to bear during actual or anticipated painful experience" (see *Sullivan MJL et al. Theoretical perspectives on the relation between catastrophizing and pain. Clin J Pain 2001, 17: 52 – 64*.).

In this report only the 13-item **PCS total score** is linked to the T-score metric of the UW-CAP scale v1.0. Linking for subscales of the PCS is not included in this report.

The University of Washington Concerns About Pain (UW-CAP) scale v1.0: The UW-CAP was similarly developed to measure an individual's level of pain catastrophizing. The construct was defined by the UW team as "Pain catastrophizing cognitions are extremely negative appraisals (thoughts) about pain, and its impact on one's life now and in the future. It includes magnification of pain and its impact, helplessness, rumination, and beliefs about the worst-case scenarios." (see *Amtmann D, Bamer AM, Liljenquist KS, Cowan P, Salem R, Turk DC, Jensen MP. The Concerns About Pain (CAP) Scale: A Patient-Reported Outcome Measure of Pain Catastrophizing. J Pain. 2020 Nov-Dec;21(11-12):1198-1211.*) Scores on the UW-CAP are not linked to PCS scores in this report (only vice versa). The UW-CAP T-score distributions are standardized such that a score of 50 with a standard deviation of 10 represents the average (mean) of the calibration sample. A higher UW-CAP score represents more pain catastrophizing.

Linking Population

The linking in this report was done using the original UW-CAP calibration sample (N=795). The UW-CAP was developed in a sample of adults living with chronic pain (mild to severe pain with average pain intensity of 3 or above on a scale from 0 to 10 for six months or longer and for at least half the days). The calibration sample was collected to adequately represent individuals with different demographic characteristics (e.g., male gender, Hispanic and African American race/ethnicity, less than high school education, younger (<45 years) and older (75+ years) age) of people with pain. For more details about the linking population please see: *Amtmann D, Bamer AM, Liljenquist KS, Cowan P, Salem R, Turk DC, Jensen MP. The Concerns About Pain (CAP) Scale: A Patient-Reported Outcome Measure of Pain Catastrophizing. J Pain. 2020 Nov-Dec;21(11-12):1198-1211.*

Linking Approach

The linking table developed allows for translating the legacy PCS score to the UW-CAP score, but not from the UW-CAP to the PCS score. That is, the raw summed score on the PCS instrument is mapped to the T-score of the UW-CAP instrument/bank. In this linking report, fixed parameter item response theory (IRT) calibration was used to link the two scores. This is possible because individuals in the calibration sample completed both the PCS and the UW-CAP at the same assessment. Fixed parameter calibration involves fixing the UW-CAP item parameters at their final bank IRT parameter values (i.e. their original calibration parameter values), and then using a graded response IRT model to calibrate the PCS items so that the PCS items may be placed on the same metric as the UW-CAP items. Recalibrating all items as one new item bank or updating the UW-CAP item parameters is not desired because that would change the scoring of the UW-CAP scale. However, fixed parameter calibration linking is only feasible when the dimensionality of the item bank is not altered significantly (i.e., where a unidimensional IRT model is suitable for the combined set of PCS + UW-CAP items). Thus, prior to conducting IRT linking, we assessed unidimensionality of the combined item bank set using a one factor confirmatory factor analysis. If unidimensionality is confirmed, PCS items can be calibrated to the UW-CAP scale metric. This new combined item bank (PCS + UW-CAP) can then be used for standard computation of IRT scaled scores from any subset of the items (i.e. just the PCS items can be scored as a short form on the UW-CAP T-score metric).

This linking approach is also commonly used by the PROMIS network (https://www.healthmeasures.net/) in linking legacy measures to PROMIS measures. Additional information about this approach can be found on the PROsetta Stone website (https://www.prosettastone.org/). Linking analyses for this report were conducted using the freely available PROsetta R package (see https://cran.r-project.org/web/packages/PROsetta/).

Linking Results

As a first step, we assessed unidimensionality of the combined set of PCS and UW-CAP items. Unidimensionality was supported as CFI and TLI for the one-factor confirmatory factor analysis were both ≥ 0.92. Local dependence was also examined (another assumption of IRT) using output of the CFA. No PCS items had residual correlations with any other item >0.2, supporting a local independence. Once the PCS items were calibrated to the UW-CAP metric, a conversion table mapping simple summary scores to T-scores was generated for cross-walking PCS scores to the UW-CAP metric (see linking table below). The standard error associated with the scaled score is also provided.

Within the linking sample, the correlation between directly measured UW-CAP scores and PCS-to-UW-CAP cross-walked scores was 0.84. The average difference between directly measured

and cross-walked scores was -0.05 points with a standard deviation of 5.5 points. Within the sample, 67% had score differences of less than 5 points (or ½ SD on the T-score metric). Figures 1 and 2 below demonstrate graphically the agreement between the directly measured and cross-walked CAP scores. As demonstrated in the figures, cross-walked scores are not perfectly accurate. Cross-walked scores may have larger error (i.e., measurement error plus linking error) compared to the original instrument scores. Thus, researchers who have switched instruments during ongoing data collection (i.e., from PCS to UW-CAP) should be aware of the associated reduction in reliability.

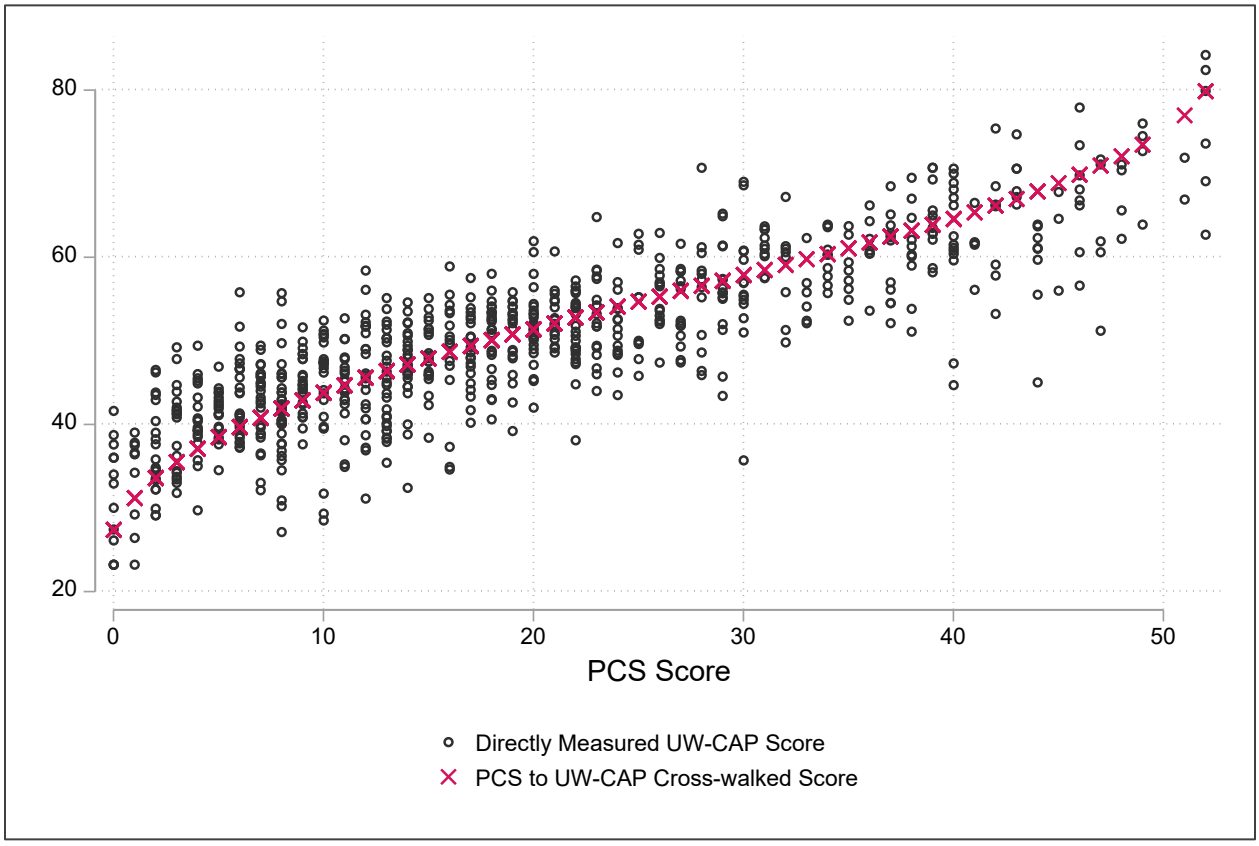

Figure 1. Graph displaying directly measured and cross-walked scores on the UW-CAP based on PCS summary scores. The X indicates the cross-walked score associated with the PCS sum score as provided in the cross-walk table. The **o** indicates the directly measured UW-CAP score.

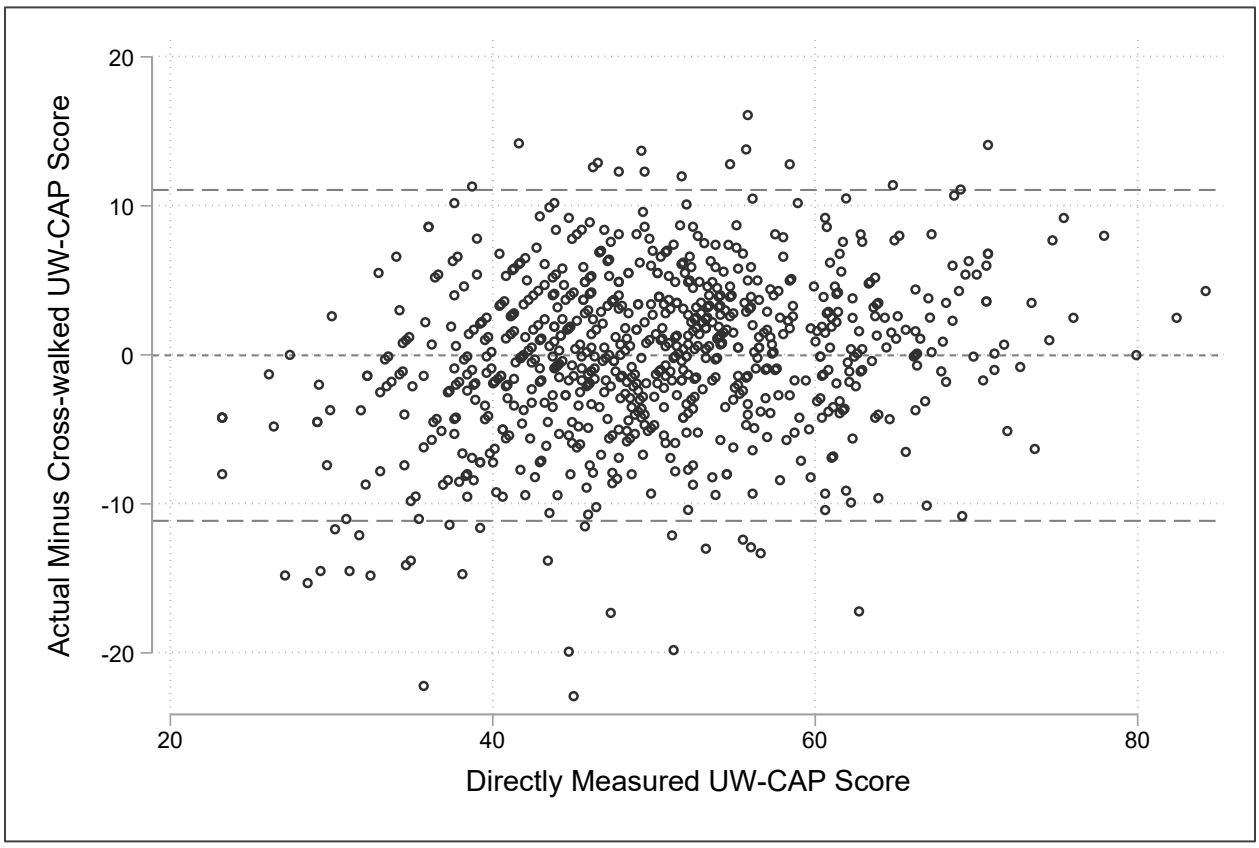

Figure 2. Bland-Altman like plot displaying the difference between the directly measured and cross-walked scores on the UW-CAP (y-axis) across the T-score continuum of the directly measured UW-CAP score (x-axis). Dashed lines represent the 95% upper and lower limit.

How to Use the Linking Table

The linking table below provides a way to convert scores on the PCS to the UW-CAP. This will allow users to synthesize research findings that utilize these two different measures, more easily transition between these two measures in clinical practice or longitudinal research, and map known clinical score cut points on the PCS to the UW-CAP.

Linking the Scores:

1. Score the PCS measure as directed by the PCS developers. This requires calculating a summary score for the 13 items. The response options should range from 0 (“not at all”) to 4 (“all the time”) for each of the 13 items. Thus, the total score on the PCS should range from 0 to 52. If you are missing a response to any of the 13 items, you **cannot** use the linking table provided without first imputing the missing value. In this situation we

recommend you use imputation methods recommended by PCS or other methods for dealing with missing data prior to cross-walking.

2. Find your PCS summary score in the linking Table 1 below. “Walk across” to the next column to determine the corresponding UW-CAP value. For example, a PCS score of 39 corresponds to a UW-CAP score of 63.9 with an SE of 2.4.
3. You can calculate a confidence interval if you desire. The formula for a 95% CI is equal to T-score ± (1.96*SE). So, in this example, there is a 95% probability that a PCS score of 39 corresponds to a UW-CAP score between 59.2 and 68.6.
4. Repeat steps 1 to 3 for all individuals in your dataset.

Table 1. Raw summary score to T-score conversion table for PCS to UW-CAP v1.0 using IRT fixed parameter calibration linking

PCS Sum Score	UW-CAP T-score	SE	PCS Sum Score	UW-CAP T-score	SE
0	27.4	4.9	27	56.0	2.2
1	31.1	3.9	28	56.6	2.2
2	33.6	3.5	29	57.2	2.2
3	35.5	3.2	30	57.9	2.2
4	37.0	3.0	31	58.5	2.2
5	38.4	2.9	32	59.1	2.3
6	39.7	2.8	33	59.8	2.3
7	40.8	2.7	34	60.5	2.3
8	41.9	2.6	35	61.1	2.3
9	42.9	2.6	36	61.8	2.3
10	43.8	2.5	37	62.5	2.3
11	44.7	2.5	38	63.2	2.3
12	45.5	2.4	39	63.9	2.4
13	46.4	2.4	40	64.6	2.4
14	47.1	2.4	41	65.4	2.4
15	47.9	2.4	42	66.2	2.5
16	48.6	2.3	43	67.1	2.5
17	49.4	2.3	44	67.9	2.6
18	50.1	2.3	45	68.9	2.6
19	50.8	2.3	46	69.9	2.7
20	51.4	2.3	47	71.0	2.8
21	52.1	2.3	48	72.2	3.0
22	52.8	2.3	49	73.5	3.2
23	53.4	2.2	50	75.1	3.4
24	54.1	2.2	51	77.1	3.7
25	54.7	2.2	52	80.1	4.4
26	55.3	2.2			