

Pain Related Functional Limitations of Persons Injured in Car Accidents

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ABSTRACT

Background: In medical psychology, the Brief Pain Inventory (BPI) allows for a separate assessment of pain intensity (scales of worst, least, and average pain) and of daily functional limitations due to pain (impairments of mood, ability to walk, work, interpersonal relations, sleep, and enjoyment of life). The present study evaluates the convergent validity of BPI's measure of such functional limitations by calculating its correlations to other relevant clinical measures of psychological impairments caused by motor vehicle accidents (MVAs).

Method: De-identified archival data were available on 50 persons injured in MVAs (age 20 to 86 years, mean=42.1 years, SD=16.4; 23 males, 27 females). Their MVA occurred 11 to 280 weeks prior to psychological testing with the BPI (average time lapse 73.3 weeks, SD=53.8). All patients were still experiencing active post-MVA symptoms requiring medical attention and therapy. With respect to convergent validity, we examined Pearson correlations of the BPI to the Insomnia Severity Index (ISI), Rivermead Post-Concussion Symptoms Scale, Subjective Neuropsychological Symptoms Scale (SNPSS), and to measures of depression, anger, and anxiety (Items 10 to 12 of the Whiplash Disability Questionnaire).

Results: Functional interference of pain with daily activities (sum of BPI Items 9B to 9G) correlated significantly at $p<0.05$, 2-tailed with Rivermead post-concussion scores ($r=0.39$), post-MVA subjective neuropsychological symptoms ($r=0.45$), insomnia scores ($r=0.41$), and ratings of depression ($r=0.52$), anger ($r=0.46$), and anxiety ($r=0.44$). When the sum of BPI ratings of worst, least, and average pain was added to the functional interference/limitations score, then this sum of 9 BPI items correlated significantly at $p<0.05$, 2-tailed with Rivermead post-concussion scores ($r=0.36$), post-MVA subjective neuropsychological symptoms ($r=0.46$), insomnia scores ($r=0.37$), and ratings of depression ($r=0.53$), anger ($r=0.50$), and anxiety ($r=0.40$).

Discussion and Conclusion: The results lend support to convergent validity of the BPI when applied to persons injured in vehicular accidents.

Keywords: Brief pain inventory, insomnia, pain, post-concussion syndrome, whiplash syndrome.

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I. INTRODUCTION

The Brief Pain Inventory (BPI) [1], [2] is a questionnaire style measure of pain that facilitates communication between patients and medical staff with respect to the patients' subjective experience of pain thus helping to quantify the need for treatment or management.

The BPI has proved clinically effective and is used worldwide. It has been translated into many languages, including Spanish, Portuguese, Chinese, Russian, German, Italian, Norwegian, French, Polish, Korean, Arabic, Hebrew, Persian, Turkish, Thai, Malay, Xhosa, and Amharic, as evidenced by numerous references in Google Scholar.

The core components of the BPI include:

(1) a measure of the *pain intensity* (sensory dimension) represented by BPI Items 3 to 6.

(2) a measure of *pain interference in the patient's life* (reactive dimension), represented by BPI Items 9A to 9G. These items assess the restriction of the patient's lifestyle due to chronic pain and help quantify the physical and emotional limitations imposed on the patient by pain [3].

Investigations have shown that as the pain is treated, the BPI scores decrease [4]. This trend per se provides satisfactory evidence of criterion validity for the BPI.

The BPI was originally developed for use in patients with cancer pain [2]. Subsequent studies validated the BPI in non-cancer pain, [5] such as arthritis or low back pain [6]. The American Psychological Association requires that a new test be validated on each clinical group for which it is used [7]. The present study examines the statistical evidence for convergent validity of the BPI in persons injured during motor vehicle accidents (MVAs). The core components of the BPI representing pain intensity and interference of pain with

lifestyle are the most important sections and are present both in the long forms and short forms of the BPI.

II. METHOD

This study analyzed de-identified archival data of 50 persons (23 males, 27 females) injured in motor vehicle accidents (MVAs). Their age ranged from 20 to 86 years with the mean at 42.1 years, SD = 16.4. Their MVA occurred 11 to 280 weeks before psychological testing with the BPI (average time lapse 73.3 weeks, SD=53.8). All patients, however, still experienced active post-MVA symptoms requiring medical attention and therapy.

Our study focused on two core parts of the short form of the BPI, i.e., its measures of pain intensity and the measures of pain interference with patient's daily activities [3].

The most important BPI measures of pain intensity are BPI Items 3 to 5: these items require patients to rate their worst pain (Item 3), least pain (Item 4), and average pain (Item 5) via scales from 0 ("no pain") to 10 ("pain as bad as you can imagine"). The common instruction given to patients in the short form of the BPI for Item 3 is "*Please rate your pain by marking the box beside the number that best describes your pain at its worst in the last 24 hours.*" Similarly, the instruction for BPI Items 4 and 5 (least pain and average pain, respectively) also specifies the time span of "*the last 24 hours.*" In some versions of the BPI, however, the standard instruction for Item 3 is "*Please rate your pain by circling the one number that best describes your pain at its worst in the last week,*" and similarly, the instruction for BPI Items 4 and 5 (least pain and average pain, respectively) also specifies the time span as "*in the last week.*" We used slightly modified instructions for ratings on Items 3 to 5: patients were to rate their pain as it was "*on a typical recent day.*"

Item 6 of the BPI asks the patients to rate "*how much pain you have right now,*" on a scale of 0-10. The de-identified files of our patients' did not include their responses to Item 6. However, the intensity of pain at the brief moment of assessment is not necessarily representative of the person's pain level in general, i.e., the typical level of suffering.

The key BPI measures of pain-related limitations of patients' daily activities are its items 9A to 9G: these items require the patients to rate the extent to which their pain interfered with their daily activities, via scales from 0 ("does not interfere") to 10 ("completely interferes"). We focused on BPI Items 9B to 9G: interference with subjective mood, walking ability, work and housework, relationships to other people, sleep, and the enjoyment of life. The de-identified clinical archives of our patients' did not include the patients' responses to BPI Item 9A (interference of pain with "general activity") as the interpretations of this item by patients can vary extensively.

Most patients in this sample still experienced grueling and debilitating pain: the mean rating of average pain on the scale from 0 (no pain) to 10 (pain as bad as you can imagine) was 6.7, SD=1.6, i.e., indicating a slightly higher than moderate level of pain.

The most frequent locations of pain in this sample of post-MVA patients were as follows: 90.0% of the patients reported headaches, 82.0% reported neck pain, and 74.0% lower back

pain. In this sample, 58.0% of patients reported pain in all these 3 locations.

Most patients in this sample also experienced the post-concussion syndrome: their scores ranged from 14 to 64 on the Rivermead scale [8],[9], with mean=40.6, SD=13.3). Their scores on the Subjective Neuropsychological Symptoms Scale (SNPSS)[10] ranged from 0 to 46 with the mean at 18.8 points (SD=11.6). The SNPSS measures post-concussive symptoms that are not listed in the Rivermead scale (syndrome of word finding difficulty, tinnitus, impaired balance) and symptoms of the cervical and lumbosacral whiplash [11] such as tingling, numbness, reduced feeling in the limbs, or reduced muscular control over the limbs.

Also available were the patients' ratings on the Insomnia Severity Index [12]: ratings ranged from 2 to 28 points with the mean at 21.8, SD=4.9. Patients also completed Items 10 to 12 of the Whiplash Disability Questionnaire [13], that is, ratings of depression, anger, and of anxiety via scales from 0 ("not at all") to 10 ("always"). Their ratings of depression ranged from 1 to 10 points, with the mean at 7.7 (SD=2.1). Those of anger ranged from 4 to 10, with the mean at 7.8 points (SD=1.6). Those of anxiety ranged from 0 to 10, with the mean at 8.1 points (SD=1.9).

In their accidents, 34 patients were the drivers, 8 passengers, two were cyclists, one drove a motorcycle, and 5 were pedestrians hit by a car. Forty-four patients had no previous vehicular accident associated with injuries, 5 had one, and one patient had 2 such previous accidents.

III. RESULTS AND DISCUSSION

A. BPI Measures of Pain Intensity

As explained, the BPI Items 3 to 5 require the patients to rate their worst pain, least pain, and average pain via scales from 0 ("no pain") to 10 ("pain as bad as you can imagine"). The mean responses of patients to these 3 BPI items are listed here in Table I. The results indicate that, on the average, the pain intensity was within the moderate or moderate to severe level.

TABLE I: RATINGS OF PAIN INTENSITY BY POST-MVA PATIENTS (N=50)

	Mean	SD	Range
PAIN INTENSITY:			
Worst pain (BPI Item 3)	8.3	1.5	2-10
Least pain (BPI Item 4)	5.1	2.3	0-10
Average pain (BPI Item 5)	6.7	1.6	1-10
PERCENT REPORTING			
% above 7 points			
SEVERE PAIN:			
Worst pain		80.0%	
Least pain		14.0%	
Average pain		26.0%	
FLUCTUATION OF PAIN			
INTENSITY:			
Worst minus Least pain	3.3	2.1	0-9
PERCENT OF PATIENTS WITH			
NO FLUCTUATION:			
		10.0%	

Legend: the mean data, SDs, and ranges are from ratings on a scale from 0 (lowest intensity of pain) to 10 (the highest intensity).

The majority of patients (80.0%) rated their worst pain above 7 points on the scale from 0 to 10, i.e., as severe or very severe. In contrast, only 14.0% of least pain ratings and only 26.0% of average pain ratings fell into that category.

The arithmetic difference between the patient's ratings of

worst and of least pain can be used as a measure of pain fluctuation. In some patients, this fluctuation can be as high as 9 points: in the present study, one patient reached this fluctuation score.

Very few patients (10.0% of our sample) showed no fluctuation of their pain, i.e., they provided an identical rating for their worst, least, and average pain.

B. Pain Related Functional Limitations of Post-MVA Patients

As shown in Table II, the pain interfered severely with the patients' sleep (mean rating of 8 points). This is often due not only to reduced sleep duration, but also to impaired sleep quality. In extreme, some post-MVA patients spend more than 20 hours per day in bed trying to sleep, but either obtain only 2 to 5 hours of real sleep or sleep is too fragmented, too shallow, or disturbed by post-accident nightmares.

The lowest levels of pain interference with lifestyle were reported for the ability to walk and for relations to other persons (ratings < 7 points), however, the extent of interference is still at least moderate.

Almost two-thirds of patients report that their pain interferes severely with work or enjoyment of life (61.2% of patients had ratings > 7 points).

A noteworthy medical aspect of pain is its function as a warning signal. Pharmaceutically marketed medications such as acetaminophen or oxycodone do not heal, but only conceal pain for a limited number of hours during which many patients, in the absence of pain as a warning signal, may imprudently engage in some strenuous but urgently needed household activities or employment chores, thus repeatedly

reactivating or even exacerbating their various tissue injuries. In these particular situations, such use of analgesic medications most probably delays and obstructs the patient's return to the workforce.

TABLE II: IMPACT OF PAIN ON LIFESTYLE ACTIVITIES (N=49)

Interference of pain with lifestyle	Mean	SD	Range	% > 7
Mood (BPI Item 9B)	7.7	1.9	2-10	57.1%
Walking ability (BPI Item 9C)	5.6	2.9	0-10	34.7%
Work and housework (BPI Item 9D)	7.6	2.2	0-10	61.2%
Relations with other people (BPI Item 9E)	6.7	2.4	0-10	40.8%
Sleep (BPI Item 9F)	8.0	1.7	3-10	71.4%
Enjoyment of life (BPI Item 9G)	7.6	2.2	1-10	61.2%

Legend: the mean data, SDs, and ranges are from ratings on a scale from 0 (the lowest degree of interference with lifestyle activities) to 10 (the highest degree).

C. Convergent Validity of the BPI Interference Measure

The BPI Items 9B to 9G listed in Table II are used in the present study as the Pain Interference Scale to quantify the magnitude of pain interference with patient's lifestyle.

Convergent validity (also referred to as concurrent validity) is the extent to which the scale correlates with variables to which it is theoretically expected to be related. Thus, the Pain Interference Scale of the BPI should correlate positively with psychological variables that are adversely affected by chronic pain, i.e., variables such as subjective symptoms within the post-concussion and whiplash spectrum, and the levels of depression, anger, and generalized anxiety, along with measures of sleep quality. These correlations are listed in the Table III.

TABLE III: CORRELATIONS OF PAIN INTERFERENCE AREAS WITH CONCUSSION, WHIPLASH, DEPRESSION, ANGER, ANXIETY, AND SLEEP

	Rivermead	SNPSS	Depression	Anger	Anxiety	ISI
Mood	0.35	0.32	0.69	0.52	0.43	0.34
Walking	0.16 p=0.280	0.38	0.37	0.20 p=0.172	0.18 p=0.218	0.14 p=0.342
Work	0.34	0.41	0.32	0.42	0.25 p=0.085	0.31
People	0.36	0.28 p=0.055	0.28 p=0.055	0.39	0.33	0.29
Sleep	0.32	0.28 p=0.055	0.34	0.17 p=0.247	0.44	0.54
Enjoyment	0.33	0.39	0.43	0.45	0.45	0.36
Sum of the above 6 interference items	0.39	0.45	0.52	0.46	0.44	0.41

Legend: the probability levels (p values) are listed only for correlation coefficients which were not significant at $p < 0.05$, 2-tailed.

As explained in the Method section, sleep quality was measured by the Insomnia Severity Index (labelled as ISI in Table III), post-concussion syndrome by the Rivermead Post-Concussion Symptoms Scale (labelled as "Rivermead" in Table III), additional post-concussive symptoms as well as some subjective whiplash symptoms were measured by the Subjective Neuropsychological Symptoms Scale (labelled as "SNPSS" in Table III), and depression was measured by Item 10, anger by Item 11, and anxiety by Item 12 of the Whiplash Disability Questionnaire.

The total score on the Pain Interference Scale can be calculated from the sum of all 6 items (9B to 9G). When this total score is divided by the number of items, i.e., by 6, this results in the average of 7.3 (SD=1.8) and range from 2.8 to 9.7 on the scale from 0 to 10. The last row of Table III contains the correlational data based on this total score on the

Pain Interference Scale.

In general, individual items of a questionnaire can be expected to correlate less well with an external criterion of validity than a total score on the questionnaire. This is shown by some non-significant correlations of certain individual items of the Pain Interference Scale to the other clinical measures of symptoms of post-MVA patients. It should be noted, however, that all correlations involving the sum of all 6 pain interference items are significant, see the last row of Table III. This provides a strong evidence for convergent validity of the BPI.

Neither any of the 6 individual items of the Pain Interference Scale nor its total score significantly correlated with age, gender, number of previous MVAs, or with time elapsed since the last MVA (Pearson r_s , $p > 0.05$, 2-tailed).

The total score on this 6 item Pain Interference Scale

correlated highly with the BPI measure of pain intensity, i.e., with the sum of the worst, least, and average pain (Pearson $r=0.74$).

D. Internal Consistency of the Pain Interference Scale

Cronbach alpha coefficient of internal consistency calculated for the group consisting of the 6 pain interference items is 0.85, i.e., highly satisfactory.

The deletion of any one of these 6 items does not lead to a major change in the overall alpha of the Pain Interference Scale: the coefficients still ranged from 0.79 to 0.85. The lowest item total correlation (i.e., the correlation of a particular item to the sum of the other 5 items) was found for interference of pain with sleep ($r=0.53$) and the highest was for interference of pain with enjoyment of life ($r=0.81$). Thus, the overall psychometric properties of the scale formed by these 6 BPI items appear satisfactory as a scale of functional limitation of lifestyle by pain.

E. Convergent Validity of BPI Measures of Pain Intensity

The Table IV lists Pearson correlations of the worst, least, and average pain to subjective symptoms within the post-concussion and whiplash spectrum, and to depression, anger, anxiety, and sleep quality. The fifth row of Table IV lists correlations of the sum of the 3 measures of pain intensity

(worst + least + average pain) to the other clinical measures.

The last row of Table IV lists correlations of the size of the difference between worst and least pain intensity (worst pain minus least pain) to the other clinical measures.

The worst pain correlated significantly with the post-concussion syndrome as measured by Rivermead, with the post-concussive and whiplash measure provided by the SNPSS, and with ratings of depression, anger, and anxiety, and sleep. This correlational pattern is consistent with the clinical view of the worst pain as indicating the degree of injury: the size of these correlations demonstrates a satisfactory level of convergent validity for the BPI measure of the worst pain.

The BPI measure of least pain shows the lowest correlations to the other clinical measures. Nevertheless, the lowest pain ratings are also clinically relevant because they provide important additional information in clinical assessment of patients, and the same seems true of the ratings of average pain.

The size of fluctuations in the level of pain (worst pain minus least pain) was not significantly correlated to the other clinical measures, except for the Rivermead post-concussion scale. However, this correlation with the Rivermead is weak and does not provide an adequate basis for practical clinical predictions.

TABLE IV: CORRELATIONS OF PAIN INTENSITY WITH CONCUSSION, WHIPLASH, DEPRESSION, ANGER, ANXIETY, AND SLEEP

Pain intensity	Rivermead	SNPSS	Depression	Anger	Anxiety	ISI
Worst pain	0.40	0.40	0.47	0.51	0.37	0.32
Least pain	-0.01	0.27	0.28	0.33	0.11	0.16
	p=0.928	p=0.059	p=0.051		p=0.453	p=0.277
Average pain	0.20	0.40	0.51	0.52	0.26	0.18
	p=0.174				p=0.067	p=0.213
Sum of the 3 scales ("intensity")	0.19	0.39	0.46	0.49	0.26	0.24
	p=0.193				p=0.073	p=0.097
Worst minus least pain	0.30	-0.01	0.03	0.01	0.14	0.06
		p=0.927	p=0.851	p=0.969	p=0.331	p=0.692

Legend: the probability levels (p values) are listed only for correlation coefficients which were not significant at $p<0.05$, 2-tailed.

TABLE V: CORRELATIONS OF PAIN INTENSITY PLUS INTERFERENCE WITH CONCUSSION, WHIPLASH, DEPRESSION, ANGER, ANXIETY, AND SLEEP

	Rivermead	SNPSS	Depression	Anger	Anxiety	ISI
Sum of pain intensity and interference	0.36	0.46	0.53	0.50	0.40	0.37

F. The Sum of Intensity and Interference

As detailed above, the core domains of the BPI are the measures of pain intensity (the worst + least + average pain) and of pain limitations on the patient's lifestyle (mood, walking, work, interpersonal relationships, sleep, enjoyment of life). When these 9 BPI items are added, they can be used clinically as a BPI total score. The Table V lists correlations of this total score to the post-concussion syndrome as measured by Rivermead, with the post-concussive and whiplash measure provided by the SNPSS, and ratings of depression, anger, anxiety, and sleep.

All correlation coefficients in this table are significant at $p<0.05$, 2-tailed. This provides satisfactory evidence for convergent validity of the BPI.

G. Criterion Validity of the BPI

The instructions for completing the BPI explain that this questionnaire is not about minor and transient pain most

persons sometimes have: "Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain today?"

In medical evaluation of post-MVA patients, the BPI is usually used as a measure of their chronic post-accident pain such as at 6 months or even several years after the accident. A criterion validity study of the BPI for such special patient groups needs to include methodology other than the usual normal control group of persons "free of chronic pain" as their BPI scores would obviously be zero (as can be readily verified by interviewing a small sample of such normal persons). Studies such as those comparing ratings of the extent of whiplash injuries on MRIs to the patients' BPI scores may be of special interest in evaluations of BPI's criterion validity.

Evidence for the criterion validity of the BPI has been already provided by the documented decrease of BPI scores

when pain is treated[4]: the BPI is a tool for quantifying the patients' subjective experience with pain and as such, also reflects the quantitative decrease of pain with treatment.

H. The Strength and Weaknesses of this Study

Self-ratings such as those of pain by patients on the BPI can be seen as inaccurate due to their subjective nature, yet they allow some much needed quantifiable communication between the patient and medical staff. They also provide data for quantitative studies that can confirm or question clinical intuition of pain specialists. Studies comparing BPI scores to objective medical findings such as on MRI are much needed.

Five correlation coefficients in Table III are somewhat inflated because they evaluate relationships of partly overlapping variables, as in the case of the correlation of the ratings of sleep disruption by pain (Item 9F of the BPI) to scores on the Insomnia Severity Index, or to the Rivermead scores (one of the Rivermead items is disturbed sleep as a post-concussive symptom). Similar inflation is probably also present in correlations of depression, or anger, or anxiety to the BPI Item 9B (impact of pain on mood). These correlations should not be over-interpreted: the reader must remain aware that they are correlations of partly overlapping variables. The relative proportion of overlap is somewhat reduced if focusing mainly on correlations of the total score on the Pain Interference Scale (see the last row of Table III) and those coefficients were all significant.

IV. CONCLUSIONS

The Pain Interference Scale of the Brief Pain Inventory (BPI) is significantly correlated with measures of post-concussion and whiplash syndrome, post-accident insomnia, and measures of depression, anger, and anxiety. This confirms its convergent validity in assessments of persons injured in motor vehicle accidents (MVAs).

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REFERENCES

- [1] C.S. Cleeland, "The Brief Pain Inventory - User Guide," Houston, TX: The University of Texas M. D. Anderson Cancer Center, 2009.
- [2] C.S. Cleeland, & K.M. Ryan, "Pain assessment: Global use of the Brief Pain Inventory," *Annals, Academy of Medicine, Singapore*. 1994;23(2):129-138.
- [3] C.Y. Song, S.F. Lin, C.Y. Huang, H.C. Wu, C.H. Chen, C.L. Hsieh, "Validation of the Brief Pain Inventory in Patients With Low Back Pain," *Spine*. 2016;41(15):E937-E942. doi: 10.1097/BRS.0000000000001478.
- [4] G. Newshan, M. Lefkowitz, "Transdermal fentanyl for chronic pain in AIDS: a pilot study," *Journal of Pain and Symptom Management*. 2001;21910:69-77.
- [5] G. Tan, M.P. Jensen, J.I. Thornby, B.F. Shanti, "Validation of the brief pain inventory for chronic nonmalignant pain," *The Journal of Pain*. 2004;5(2):133-137. https://doi.org/10.1016/j.jpain.2003.12.005.
- [6] S. Keller, C.M. Bann, S.L. Dodd, J. Schein, T.R. Mendoza, C.S. Cleeland, "Validity of the Brief Pain Inventory for Use in Documenting the Outcomes of Patients With Noncancer Pain," *The Clinical Journal of Pain*. 2004;20(5):309-318.
- [7] American Educational Research Association, American Psychological Association, National Council on Measurement in Education, "The Standards for Educational and Psychological Testing," Washington, DC.: AERA Publications, 2014.
- [8] N.S. King, S. Crawford, F.J. Wenden, N.E.G. Moss, D.T. Wade, "The Rivermead Post Concussion Symptoms Questionnaire: a measure of symptoms commonly experienced after head injury and its reliability," *Journal of Neurology*. 1995;242:587-592.
- [9] Z.Z. Cernovsky, S.C. Mann, V. Velamoor, L.K. Oyewumi, D.M. Diamond, and L.C. Litman, "Validation of the Rivermead Post-Concussion Symptoms Questionnaire (RPQ) on Patients Injured in High Impact Car Accidents," *Archives of Psychiatry and Behavioral Sciences*. 2021;4(1):14-22. doi.org/10.22259/2638-5201.0401003.
- [10] Z.Z. Cernovsky, L.C. Litman, S.C. Mann, L.K. Oyewumi, Y. Bureau, J.D. Mendonça, D.M. Diamond, H. Raheb, "Validation of the Subjective Neuropsychological Symptoms Scale (SNPSS) in Injured Motorists," *Archives of Psychiatry and Behavioral Sciences*. 2021;4(1):6-13. doi: 10.22259/2638-5201.0401002.
- [11] Z.Z. Cernovsky, S.C. Mann, V.R. Velamoor, and L.K. Oyewumi, "The Need for Three Separate Parallel WAD Ratings of Whiplash Injuries to Cervical, Lumbosacral, and Thoracic Spine in Clinical Assessments of Injured Motorists," *European Journal of Medical and Health Sciences*. 2021;3(1):1-6. doi: 10.24018/ejmed.2021.3.1.699.
- [12] C.M. Morin, G. Belleville, L. Bélanger, H. Ivers, "The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response," *Sleep*. 2011;34(5):601-8.
- [13] M. Pinfold, K.R. Niere, E.F. O'Leary, J.L. Hoving, S. Green, R. Buchbinder, "Validity and internal consistency of a whiplash-specific disability measure," *Spine (Philadelphia, Pa, 1976)*. 2004;29(3):263-8.

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