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The Pain Behaviors for Osteoarthritis Instrument for Cognitively Impaired Elders (PBOICIE)

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Abstract

Severely cognitively impaired (CI) elders have trouble responding to questions about their osteoarthritis knee or hip pain, making pain management difficult. Thus, the Pain Behaviors for Osteoarthritis Instrument for Cognitively Impaired Elders (PBOICIE) was developed as an alternative. This article reports the development and psychometric testing of the PBOICIE in three studies.

The 6-item PBOICIE was not associated with the Verbal Descriptor Scale, but was significantly associated with Keefe's method for observing pain behaviors in patients with knee or hip osteoarthritis, with r=.36–.55, indicating good concurrent validity. The 6-item PBOICIE was able to discriminate elders' pain behaviors before and after analgesic administration (2.9 ± 1.89 vs. 1.97 ± 1.98; p<.001).

This study has shown that multifaceted pain assessments are needed in elders with osteoarthritis knee or hip pain since the observed behaviors did not parallel, but added information to verbal report.

Keywords

Pain; Osteoarthritis; Measurement; Dementia

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Osteoarthritis (OA) of the knee or hip is the leading cause of disability in elders (Campbell *et al.*, 1994) and is a significant source of pain and suffering in cognitively impaired (CI) elders. It is estimated that 48% to 65% of CI elders have OA (Marzinski, 1991; The Canadian Study of Health and Aging, 1994). Without proper treatment of their pain, these elders may forego physical activities to avoid aggravating the pain, thus further impairing their physical and cognitive function and increasing their need for assistance. Other consequences of unrelieved pain include depression, sleep disturbances, withdrawal, falls and fall-related injuries, and malnutrition (Ferrell & Ferrell, 1990; Rubenstein & Josephson, 2002). Overall, unrelieved pain decreases quality of life for CI elders, adds to caregiver burden, and increases health care costs (Ferrell & Ferrell, 1990).

Accurate assessment of pain is critical for treating CI elders with OA and evaluating the outcomes of treatment. Verbal self-report of pain, representing the individual's subjective perception of pain, is the gold standard for measuring an individual's pain, and treatment decisions are generally based upon this self-report (AGS Panel on Persistent Pain in Older Persons, 2002). However, severely CI elders may have trouble responding to verbal-report pain instruments because of communication deficits, and this makes pain assessment and management difficult (AGS Panel on Persistent Pain in Older Persons, 2002). Given the high prevalence of OA in CI elders and its adverse consequences, an alternative to verbal report of pain is urgently needed for these elders.

One alternative to verbal report is assessment of the verbal or non-verbal behaviors demonstrated by patients who communicate to others that they are experiencing pain (Fordyce, 1976). Activities involving the lower extremities, such as standing, walking, rising from a bed or chair, and climbing stairs, put extra pressure on the affected knee or hip joint, aggravating the pain in patients with OA. In response, elders with OA exhibit subtle but specific non-verbal behaviors indicating knee or hip pain, but these are not included on generic pain observational tools. Elders show disturbed ambulation and gestures such as moving slowly with stiffness, rubbing or holding the affected site, shifting body weight while standing, flexing the affected joint, using mechanical help (cane or walker), or grabbing on to furniture to reduce pain (Birrell *et al.*, 2000; Keefe *et al.*, 1987; Walker *et al.*, 2001). They may also use other behaviors to express pain verbally and non-verbally, such as audible expressions of distress, facial/non-audible expressions of distress, and changes in daily routine. These provide indications of whether the elder is experiencing OA knee or hip pain. Current methods for assessing CI elders, however, do not address these indicators of OA (Feldt, 2000; Simons & Malabar, 1995; Snow *et al.*, 2003; Weiner *et al.*, 1999).

While an observational tool is available to identify OA pain in the general population, including elders (Keefe *et al.*, 1987), there is no such instrument for CI elders with OA. Current measurement tools for osteoarthritic pain have not been tested with CI elders and no one has systematically studied pain behaviors in CI elders with OA of the knee or hip. Therefore, we developed the Pain Behaviors for Osteoarthritis Instrument for Cognitively Impaired Elders (PBOICIE), an observational tool that targets the unique indicators of OA knee pain and combines the specific pain behaviors resulting from OA with other pain behaviors demonstrated by elders with CI. This paper reports the development and psychometric testing of the PBOICIE.

Three sub-studies were used to test the psychometric properties of the PBOICIE.

Study 1

This study included the initial instrument development and content validity testing.

Method

To develop items for the Pain Behaviors for the Osteoarthritis Instrument for Cognitively Impaired Elders (PBOICIE), the first author compiled pain behaviors from other observational instruments (Dirks *et al.*, 1993; Feldt, 2000; Kerns *et al.*, 1991; Richards *et al.*, 1982) and OA pain assessment instruments (Keefe *et al.*, 1987), as well as pain behaviors suggested by the American Geriatrics Society panel (AGS Panel on Persistent Pain in Older Persons, 2002) and past studies (Weiner *et al.*, 1999). Six content experts in long-term care, orthopedic care, and pain research used a 5-point scale (0=definitely not a pain behavior to 4=definitely a pain behavior) to rate each item's relevance to pain in severely CI elders with OA of the knee or hip. The Content Validity Index, i.e., the proportion of items that received a rating of 3 or above by the experts (Lynn, 1986; Waltz & Bausell, 1981), was calculated and items scored 3 or 4 by 5 out of 6 experts were retained, with a Content Validity Index at least .83. Items with a Content Validity index below .80 were deleted.

Results

Sixteen of the 49 items initially identified by the first author were retained because each of these items had a Content Validity Index of at least 0.83. These 16 items of the PBOICIE were dichotomous (0=absent or 1=present) with a potential range of 0–16.

Study 2

This study was designed to further refine the 16-item PBOICIE and pilot test its ability to discriminate pain behaviors of elders with severe dementia before and after analgesic intake.

Method

Eight severely CI elders who met the following inclusion criteria were recruited to participate in the pilot study: 1) age 60 or older, 2) diagnosis of OA of the knee or hip, 3) receiving scheduled analgesic medication for pain, 4) English speaking, 5) ambulatory, including walking with walker, and 6) Mini-Mental State Exam (MMSE) score< 10. Elders were excluded if they had 1) other painful conditions in the lower extremities, 2) Parkinsonism, or 3) an episode of vertigo during the previous month. The average age of the eight subjects was 85.13 ± 7.49 and their average MMSE score was 3.63 ± 3.78.

Research assistant (RA) 1 videotaped the elders with CI while the elders were instructed to perform the activity protocol developed by Keefe et al (1987) before and 30 minutes after analgesics were administered. The types and dosage of analgesics were prescribed by elders' healthcare providers or were over-the-counter pain medications that elders used when they were in pain. RA 1 later viewed the videotapes and counted/recorded the number of pain behaviors before and after administering the analgesics using the PBOICIE. RA1 was blinded to the elders' pain experience.

Before RA1 conducted the PBOICIE behavior coding, the first author developed specific guidelines for coding each behavior and held training sessions for RA 1. To prevent rater drift, inter-rater and intra-rater reliability were examined. RA 1 had perfect agreement and Cohen's kappa reliability with the first author in rating four participants on the PBOICIE after the initial training.

Results

The results showed that six behaviors on the PBOICIE (grunting, chanting or calling out; crying or tears; asking someone for help; talking about pain; taking pain medication; and increasing rest periods) were not observed before or 30 minutes after administering the analgesics. These items were therefore deleted, reducing the item numbers to 10. The 10-item PBOICIE is shown

in Table 1. The frequencies of observation for the remaining 10 items were between 1 and 6 for before or 30 minutes after administering the analgesics. Although the difference was not statistically significant [Paired t-test (6)=1.35, p=.23], the pilot data showed a trend toward reduced pain behaviors on the PBOICIE 30 minutes after administering analgesics (3.86 ± 1.68 vs. 3.00 ± 1.00).

Study 3

This study tested item to total correlations, the concurrent validity of the PBOICIE and its ability to discriminate pain behaviors of elders without dementia before and after analgesic intake.

Method

Since elders without dementia but with OA of the knee or hip are able to provide verbal reports of pain and demonstrate pain behaviors, this population was used to evaluate the item total correlation and concurrent validity of the 10-item PBOICIE, and its ability to discriminate elders' pain behaviors before and after analgesic intake. Thirty-two non-CI elders were recruited from a senior health clinic. Elders met the following inclusion criteria: age 60 years or older, diagnosis of OA of the knee or hip, English speaking, and Mini Mental State Exam (MMSE) score ≥25. Elders were excluded if they had: 1) other painful conditions in the lower extremities, 2) Parkinsonism, or 3) an episode of vertigo during the previous month. The average age of the 32 elders was 72.97 ± 7.88, and their average MMSE was 28.91 ± 1.30. Three quarters of the participants (N=24) were White, and 81.3% (N=26) were female. All participants signed an informed consent form.

The 10-item PBOICIE was used to observe pain behaviors (Table 1). To prevent rater drift, inter-rater and intra-rater reliability were examined. The rater for Study 2, RA 1, coded the PBOICIE. In addition to the training described in Study 2, the first author checked inter-rater reliability for every 15 to 20 observations. RA 1 achieved an average of 90% agreement and. 76 Cohen's kappa reliability with the first author for five observations during the 7-month coding period. RA 1 had an average of 92.5% intra-rater agreement and .77 Cohen's kappa reliability over a one-month period rating five participants.

Two additional pain scales or instruments were also used, Keefe's pain behaviors for osteoarthritis observation (Keefe *et al.*, 1987) and the Verbal Descriptor Scale (Herr & Mobily, 1993; Herr *et al.*, 2004). The behavior observation method developed by Keefe et al. (Keefe *et al.*, 1987) was used to score OA knee/hip pain behaviors. Keefe's method includes five behaviors that indicate OA knee pain: guarding, active rubbing of the knee, rigidity, unloading the joints, and joint flexion. In his study, Keefe found that inter-rater reliability among raters was .93 using the k-statistic. The concurrent validity of Keefe's method was evidenced by a strong correlation with the patient's self-report of pain (r=.46, p<.001). Also, patients with OA knee pain exhibited significantly more pain behaviors than patients without OA knee pain (t=2.82, p<.01) and a rheumatologist's pain rating was significantly correlated with the number of pain behaviors (r=.65, p<.01), indicating construct validity (Keefe *et al.*, 1987).

Keefe's observational method was designed for patients with OA of the knee. After consultation with Dr. Keefe, we revised the coding system to observe both *knee and hip pain*. The revised coding system included guarding (abnormally slow, stiff, interrupted or rigid movements when moving from one position to another or while walking), active rubbing of the knee or hip (hands moving to or holding affected knee or hip), rigidity (excessive stiffness of the affected knee or hip during activities other than walking), unloading the joint (shifting weight from one leg to the other while standing), and joint flexion (flexing the affected knee or hip while in a static

position). The participant received 1 point for each pain behavior. We used the total number of pain behaviors as the score.

RA 1, who coded the PBOICIE, was not involved in coding using Keefe's method. RA 2 was trained for one day at Duke University by Dr. Keefe in the use of his method to rate pain behaviors on videotape. RA 2 had initial inter-rater agreement of 98% and Cohen's kappa reliability of .82 with Dr. Keefe's research staff for five observations. Then, Dr. Keefe's research staff checked inter-rater reliability for every 10 observations. RA 2 achieved an average of 99% percentage agreement and .89 Cohen's kappa reliability for eight observations during the 7-month coding period.

RA1 and RA 2 were not blinded to the elders' verbal report of pain before or after receiving pain medication in Study 3. This is a limitation of the study. However, we used the following methods to reduce bias. First, both RAs viewed all videotapes and rated participants' pain behaviors using the PBOICIE or Keefe's method after the study was completed. The study lasted over 2 years and after 2 years, the RAs were not expected to be able to recall an elder's verbal report of pain while they coded the pain behaviors using the PBOICIE or Keefe's method. Second, the RAs were not allowed to view the elders' pain scores during the coding period. In addition, the first author served as the gold standard rating the PBOICIE against RA 1, and research staff at Duke University was the gold standard for rating the Keefe method against RA 2. Both the first author and the Duke staff were blinded to the elder's pain report and the RAs had good inter-rater reliabilities. Thus, it is unlikely that bias occurred during the coding due to knowing elders' pain report.

The Verbal Descriptor Scale (VDS) was used to measure verbal report of pain. This scale consists of a list of words indicating “no pain” to “pain as bad as it could be.” The respondent is asked to place an “X” beside the words that best describe the severity or intensity of current pain. Herr and Mobily reported that only 4.1% of elders without CI could not complete the scale, a rate comparable to that for the general population (0%–4%) (Herr & Mobily, 1993). The scale can be used in elders with less than a high school education. The VDS is significantly associated with other commonly used pain measures, such as the Pain Thermometer ($r=1.00$, $p<.001$), the Numeric Rating Scale ($r=.91$, $p<.001$), and the Horizontal-Visual Analogue Scale (.88, $p<.001$) (Herr *et al.*, 2004).

For psychometric testing of the 10-item PBOICIE, the RAs determined the most painful time during the day from self-reports by elders and obtained data on their medication, prior to the pain behavior observations. When elders came to the study lab, the RAs obtained their verbal report and then videotaped the elders while they performed the activity protocol developed by Keefe et al. before and 30 minutes after they were administered analgesics. The RAs later viewed the videotapes, counted, and recorded the number of pain behaviors before and after analgesics were administered, using both the PBOICIE and Keefe's method. Descriptive statistics, Pearson R correlation, paired t test, alpha reliability and factor analysis were used to analyze the data.

Results

Based on the item-total correlations shown in Table 2, four items of the PBOICIE (sigh, moan, grasp, or groan; words expressing discomfort; fidgeting; and restricted movement) were deleted because these items were not associated with the total PBOICIE score. The remaining items had correlation coefficients with the total score ranging from .44 to .71 ($p<.05$). Alpha reliability of the 6-item instrument was .57 measured before administering analgesics and .68 measured 30 minutes after administering analgesics.

Table 3 shows the correlations between 32 elders' self-rated pain (VDS score) and their 6-item PBOICIE scores and the rating of pain behaviors using Keefe's method. Neither the PBOICIE nor Keefe's rating of pain behaviors was associated with the VDS score before administering analgesics or 30 min after administering analgesics. The PBOICIE score was significantly associated with Keefe's rating of pain behaviors, with a Pearson's coefficient of .55 ($p<.01$) when measured before administering analgesics and a Pearson's coefficient of .36 ($p<.05$) when measured 30 min after administering analgesics.

The result showed that elders had fewer pain behaviors 30 minutes after they took the analgesics (1.97 ± 1.98) than before taking analgesics (2.9 ± 1.89) ($p<.001$), indicating that score on the 6-item PBOICIE has the ability to discriminate pain behaviors before and after analgesics intake.

Discussion

The alpha reliabilities of the 6 items were between .57 and.68 which is below the accepted criterion for internal consistency reliability (.7)(Nunnally, 1978). However, it is not unusual to have low internal consistency on this type of criterion-referenced scale. In such scales, items are selected to discriminate along a particular range of a characteristic, such as pain behaviors in this study. These items are “functional alternatives” for each other. That is, even if only one behavior on the PBOICIE is observed, it still indicates that a patient is in pain.

The final 6-item PBOICIE score was not associated with verbal report of pain using the VDS. Although self-reports of pain have limitations, they are generally accepted as the gold standard for the patient's pain experience. Intuitively, indicators of patients' pain should be related to each other because they all result from an individual's pain perception. However, this is not always the case (Keefe & Block, 1982). Associations between self-reported pain and other types of pain behavior measurement have ranged from strong to insignificant (Dirks *et al.*, 1993; Keefe & Block, 1982; McCahon *et al.*, 2005; Richards *et al.*, 1982; Weiner *et al.*, 1996). Richards and colleagues, for example, reported that the UAB (University of Alabama at Birmingham) pain behavior scale showed no association with two verbal report measures, the McGill Pain questionnaire (r=.17) and the 0–10 analog scale (r=.16) at hospital admission (Richards *et al.*, 1982). The inconsistent results between verbal report and pain behaviors may be due to chronic pain patients' adaptation to the environment and the choice of wording in verbal report instruments.

Fordyce introduced the concept of operant behaviors in pain (Fordyce, 1976); These behaviors are influenced by the response that a patient receives. For example, if a pain behavior enables a hospitalized patient to get analgesics from the staff or avoid undesired activities, such as work, it is likely to occur again. On the other hand, if a pain behavior makes no difference or makes things worse, it is not likely to occur again. In acute pain, pain behaviors are likely to indicate actual tissue damage or nociceptive stimuli. However, in chronic pain, after resolution of the pathological process and termination of nociceptive stimulation, patients' behaviors may be reinforced or weakened by interaction with the environment, and some behaviors may lose their adaptive function over time (Turk & Flor, 1987). Because of the long-term nature of osteoarthritic pain, elders' pain behaviors, including verbal report and other types of pain behaviors, might be the product of interactions with the environment and the results of adaptation to the pain, not merely the pure experience of pain. Elders may then exaggerate or underreport their pain or demonstrate behaviors that are not congruent with verbal reports of pain. Use of a variety of methods thus may be needed to assess patients with chronic pain.

We used a verbal report measurement that assessed elders' pain intensity by asking them to choose from seven descriptors (no pain, slight pain, mild pain, moderate pain, severe pain, extreme pain, pain as bad as it could be) to characterize their pain experience. We found,

however, that elders used words to express their pain experience that differed from the descriptors on the VDS, such as hurt, aching, or discomfort. Thus, future research may need to use additional words to elicit elders' description of their osteoarthritic pain.

Although the 6-item PBOICIE was not related to verbal self-report of pain, it was significantly associated with Keefe's pain observation method, which has demonstrated validity and reliability (Keefe *et al.*, 1987). The PBOICIE was also able to discriminate pain behaviors before and after analgesic administration. These findings may indicate that pain assessment should be multifaceted. As Fordyce proposed, pain behaviors are a broad umbrella that may include verbal complaints, non-language sounds, body posturing and gesturing, manifestations of functional limitation or impairment, and behaviors designed to reduce pain (such as use of medication) (Fordyce, 1976). Indicators of chronic pain include motor patterns, activity level, medications taken, and pain reports (verbal behaviors indicating pain) (Halpern, 1977; Keefe & Block, 1982; Sanders, 1980).

Turk postulated that pain behaviors could be strategies to reduce pain or the results of physical limitations and could be used to prevent initiation or exacerbation of nociceptive stimulation (Turk & Flor, 1987). For example, elders with severe OA pain are less active than elders with no pain or less pain (Kaplan *et al.*, 2003). This may actually worsen their functional limitation. Thus, the desired outcome of an intervention may not be to reduce pain, but to improve a patient's functional ability (McCahon *et al.*, 2005). In a chronic pain condition, such as osteoarthritis, change in physical function might be a useful indicator of pain experience, in addition to verbal report of pain and pain observed behaviors.

We used elders without dementia to verify the validity of the PBOICIE and to examine the PBOICIE's ability to discriminate elders' pain behaviors before and after analgesic use. There is no reason to believe that elders with severe dementia show different behaviors, but the research team will be sensitive to this possibility in future research. One limitation of our findings is that participation in a pain study may affect elders' pain behaviors and pain report. Also, noted earlier, the RAs were not blinded to elders' pain reports before and after receiving pain medication and may have influenced their ratings. Research to further assess the validity and reliability of the PBOICIE will need to include elders with moderate and severe cognitive impairment and also blind the RAs to elders' pain reports before and after receiving pain medications.

CONCLUSION

The 6-item PBOICIE demonstrated concurrent validity, as indicated by the strong correlation with Keefe's pain observational method, and has the ability to discriminate elders' pain behaviors before and after analgesic administration. This study has shown that multifaceted pain assessments are needed in elders with osteoarthritis knee or hip pain since the observed behaviors did not parallel, but added information to verbal report. In addition, asking elders with cognitive impairment about their pain using different words to elicit their pain report may help to verify the results of this study.

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References

AGS Panel on Persistent Pain in Older Persons. The management of persistent pain in older persons. Journal of the American Geriatrics Society 2002;50(6 Suppl):S205–224. [PubMed: 12067390]

Birrell F, Croft P, Cooper C, Hosie G, Macfarlane G, Silman A. Health impact of pain in the hip region with and without radiographic evidence of osteoarthritis: A study of new attenders to primary care. Annals Of The Rheumatic Diseases 2000;59(11):857–863. [PubMed: 11053061]

Campbell AJ, Busby WJ, Robertson MC, Lum CL, Langlois JA, Morgan FC. Disease, impairment, disability and social handicap: A community based study of people aged 70 years and over. Disability & Rehabilitation 1994;16(2):72–79. [PubMed: 8043887]

Dirks JF, Wunder J, Kinsman R, McElhinny J, Jones NF. A pain rating scale and a pain behavior checklist for clinical use: Development, norms, and the consistency score. Psychother Psychosom 1993;59(1): 41–49. [PubMed: 8441794]

Feldt KS. The checklist of nonverbal pain indicators (cnpi). Pain Management Nursing 2000;1(1):13–21. [PubMed: 11706452]

Ferrell BA, Ferrell BR. More research needed on geriatric pain management. Provider 1990;7:31–32.

Fordyce, WE. Behavioral methods for chronic pain and illness. C.V Mosby Company; St. Louis: 1976.

Halpern LM. Analgesic drugs in the management of pain. Archives of Surgery 1977;112(7):861–869. [PubMed: 18128]

Herr KA, Mobily PR. Comparison of selected pain assessment tools for use with the elderly. Applied Nursing Res 1993;6(1):39–46.

Herr KA, Spratt K, Mobily P, Richardson G. Pain intensity assessment in older adults: Use of experimental pain to compare psychometric properties and usability of selected scales with younger adults. The Clinical Journal of Pain 2004;20(4):207–219. [PubMed: 15218405]

Kaplan MS, Huguet N, Newsom JT, McFarland BH. Characteristics of physically inactive older adults with arthritis: Results of a population-based study. Preventative Medicine 2003;37(1):61–67.

Keefe FJ, Block AR. Development of an observation method for assessing pain behavior in chronic low back pain patients. Behavior Therapy 1982;13(4):363–375.

Keefe FJ, Caldwell DS, Queen K, Gil KM, Martinez S, Crisson JE, et al. Osteoarthritic knee pain: A behavioral analysis. Pain 1987;28(3):309–321. [PubMed: 2952935]

Kerns RD, Haythornthwaite J, Rosenberg R, Southwick S, Giller EL, Jacob MC. The pain behavior check list (pbcl): Factor structure and psychometric properties. Journal of Behavioral Medicine 1991;14 (2):155–167. [PubMed: 1880794]

Lynn MR. Determination and quantification of content validity. Nursing Research 1986;35(6):382–385. [PubMed: 3640358]

Marzinski LR. The tragedy of dementia: Clinically assessing pain in the confused nonverbal elderly. Journal of Gerontological Nursing 1991;17(6):25–28. [PubMed: 2033212]

McCahon S, Strong J, Sharry R, Cramond T. Self-report and pain behavior among patients with chronic pain. The Clinical Journal of Pain 2005;21(3):223–231. [PubMed: 15818074]

Nunnally, JC. Psychometric theory. McGraw-Hill; New York: 1978.

Richards JS, Nepomuceno C, Riles M, Suer Z. Assessing pain behavior: The uab pain behavior scale. Pain 1982;14(4):393–398. [PubMed: 7162841]

Rubenstein LZ, Josephson KR. The epidemiology of falls and syncope. Clinics in Geriatric Medicine 2002;18(2):141–158. [PubMed: 12180240]

Sanders SH. Toward a practical instrument system for the automatic measurement of “up-time” in chronic pain patients. Pain 1980;9(1):103–109. [PubMed: 7422335]

Simons W, Malabar R. Assessing pain in elderly patients who cannot respond verbally. Journal of Advanced Nursing 1995;22(4):663–669. [PubMed: 8708184]

Snow AL, Weber JB, O'Malley K, Cody M, Beck C, Bruera E, et al. Noppain: A nursing assistant-administered pain assessment instrument for use in dementia. Dementia and Geriatric Cognitive Disorders 2003;17:240–246. [PubMed: 14745230]

The Canadian Study of Health and Aging. The canadian study of health and aging: Risk factors for alzheimer's disease in canada. Neurology 1994;44(11):2073–2080. [PubMed: 7969962]

Turk D, Flor H. Pain behaviors: The utility and limitations of the pain behavior construct. Pain 1987;31:277–295. [PubMed: 3320882]

Walker CR, Myles C, Nutton R, Rowe P. Movement of the knee in osteoarthritis. The use of electrogoniometry to assess function. Journal of Bone & Joint Surgery -British Volume 2001;83(2): 195–198. [PubMed: 11284564]

Waltz, CW.; Bausell, RB. Nursing resaerch: Design, statistics and computer analysis. F. A. Davis; Philadelphia: 1981.

Weiner D, Peterson B, Keefe F. Chronic pain-associated behaviors in the nursing home: Resident versus caregiver perceptions. Pain 1999;80(3):577–588. [PubMed: 10342419]

Weiner D, Pieper C, McConnell E, Martinez S, Keefe F. Pain measurement in elders with chronic low back pain: Traditional and alternative approaches. Pain 1996;67(2–3):461–467. [PubMed: 8951942]

Table 1

The 10-Item Pain Behaviors for Osteoarthritis Instrument for Cognitively Impaired Elders (PBOICIE)

Domains		Rating Value	
		0	1
	Characteristic 1: Distorted ambulation or gesture		
1	Excessive stiffness of the affected joint during activities other than walking[+]	no	yes
2	Shifting weight (adjust body) when seated[+]	no	yes
3	Clutching or holding onto affected area[+]	no	yes
4	Massaging affected area[+]	no	yes
5	Rigid, tense body posture[+]	no	yes
	Characteristic 2: Audible expression of distress		
6	Sigh, moan, grasp, groan	no	yes
7	Words expressing discomfort or pain, “ouch,” “that hurts,”; cursing during movement; and exclamations of protest, “stop,” “that's enough”	no	yes
	Characteristic 3: Facial/non-audible expression of distress		
8	Clenching teeth[+]	no	yes
9	Fidgeting	no	yes
	Characteristic 4: Changes in daily routine		
10	Restricted movement	no	yes

[+] indicated the final 6 items.

Table 2

Item-Total Correlation Coefficients for the 10-Item PBOICIE

Item	PBOICIE total score Before administering analgesics	PBOICIE total score 30 min after administering analgesics
1. Excessive stiffness of the affected joint during activities other than walking[+]	.71***	.61***
2. Shifting weight (adjust body) when seated[+]	.48**	.61***
3. Clutching or holding onto affected area[+]	.59***	.54**
4. Massaging affected area[+]	.65***	.45**
5. Rigid, tense body posture[+]	.54**	.63***
6. Sigh, moan, grasp, groan	.13	.31
7. Words expressing discomfort or pain	.09	.31
8. Clenching teeth[+]	.44*	.52**
9. Fidgeting	.31	.17
10. Restricted movement	−.31	.08

* $p<.05$;

** $p<.01$;

*** $p<.001$.

[+] indicated the final 6 items.

Table 3

Correlation coefficients among 6-item PBOICIE, Keefe's rating of pain behaviors and VDS

Before administering analgesics	**1**	**2**	**3**	**4**	**5**	**6**
1. Six-item PBOICIE	1.00					
2. Keefe's rating of pain behavior	.55**	1.00				
3. VDS	.11	.08	1.00			

30 min after administering analgesics	**1**	**2**	**3**	**4**	**5**	**6**
4. Six-item PBOICIE				1.00		
5. Keefe's rating of pain behavior				.36*	1.00	
6. VDS				.05	.29	1.00

* $p<.05$;

** $p<.01$.