Original Article

Development and Psychometric Assessment of Barriers to Postoperative Pain Management in Dementia Scale: A Mixed Methods Exploratory Study

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Abstract

Background: Identifying the barriers to acute pain management in older adults with dementia needs appropriate instruments adapted to the cultural structure of each community. Such an instrument can help to provide effective interventions. **Objectives:** This study aimed to develop and psychometrically validate Barriers to Postoperative Pain Management in Dementia Scale (BPPMDS) from the nurses' point of view. **Methods:** This methodological study was conducted in 2019–2020. In the first phase, semi-structured interviews with 15 nurses and literature review were conducted for item generation. In the second phase, face, content, and construct validity and reliability of the instrument were assessed. **Results:** In the first phase, 67 items were produced. In the second phase, the number of items reduced to 39 after the assessment of face, content, and construct validity. Exploratory factor analysis showed that the BPPMDS has three factors (i.e., older adult-related factors, health care provider-related factors, and system-related factors), which explain 57.57% of the total variance. The Cronbach's alpha coefficient of the scale was 0.956. **Conclusions:** The BPPMDS can be used as a valid and reliable scale to measure postoperative acute pain management in older patients with dementia and hip fracture.

Keywords: *Acute pain, Critical care nursing, Dementia, Hip fracture, Older adults, Pain management*

Introduction

Hip fracture (HF) is a serious health problem in older adults. It is associated with pain and limitations in physical activity[1] and requires pain relief and rapid rehabilitation. Surgery is the most common treatment method in HF, and more than 98% of patients with HF undergo surgery.[2] Although surgery yields positive outcomes, it is accompanied by acute and severe pain, which affects the results of the intervention.[3] Older adults with dementia are at higher risk for inappropriate pain management after HF. The patient's cognitive impairment makes it difficult to verbalize pain. Furthermore, conflicting views of health-care providers about the side effects of medications in these vulnerable patients and organizational barriers such as staffing and equipment shortages make it difficult to assess and treat pain in these patients.[4] A valid instrument that fit the specific culture and structure of the healthcare system is needed to gather valid evidence and recognize the barriers to managing acute pain in older adults with dementia. Using such an instrument will improve the effectiveness of pain management interventions in older adults with dementia.[5,6]

Formerly, an instrument was developed to assess the nurses' perceived barriers to optimal pain management

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in older adults. However, this instrument focused mainly on postoperative pain management and did not pass the standard psychometric evaluations.[7] Rantala *et al*. have also conducted a literature review to develop a specific instrument to assess the barriers to postoperative pain management in HF patients with dementia.[4] This questionnaire also has not been subjected to the standard psychometric assessments, the lived experiences[8] of patients and nurses have not been used in its development process, and it has not been translated and psychometrically tested in Iran or other countries.

Nurses working in postoperative acute care units often face barriers that limit their ability to manage acute pain in older adults with dementia. Since these nurses play the most important role in caring for the aforementioned patients, studying their opinions and experiences along with reviewing the literature would be an effective way to develop a valid and reliable instrument that fits the cultural conditions and structure of the Iranian healthcare system.[9,8] Since no study has been conducted in this field and no valid and reliable instrument was available to measure the barriers to postoperative pain management in dementia patients with HFs, this study was conducted to fill the gap.

Objectives

This study aimed to design and evaluate the psychometric properties of barriers to postoperative pain management in dementia scale (BPPMDS).

Methods

A sequential explanatory mixed methods study was conducted from June 2019 to January 2020. The study was conducted in two phases in the western regions of Mazandaran province (Ramsar, Tonekabon, Chalus, and Noshahr), Iran.

First phase: Item generation

Both inductive and deductive methods were applied for item generation. An explorative qualitative study was conducted to examine the nurses' experiences and inductively generate an item pool. Nurses who had experience of caring for older adults with dementia and HFs were purposively invited to participate in the study. Finally, 15 eligible nurses participated in this phase. Semi-structured interviews were conducted to gather the participants' experiences and perceptions of barriers to postoperative pain management in patients with dementia who underwent surgery for HF. Graneheim and Lundman's approach was used to analyze the qualitative data. Accordingly, all interviews were transcribed word by word and the transcripts were read through several times to get an overall impression of the whole texts. Meaning units were identified and condensed into codes. Similar codes were grouped and then clustered into subcategories. Similar subcategories were grouped together and then clustered into categories through the constant comparison method. This process was repeatedly checked and reviewed by the research team members. The categories were labelled afterwards. The codes emerged in this phase were used to generate the initial item pool.[10] The trustworthiness of the data was checked using Guba and Lincoln's four criteria of credibility, dependability, conformability, and verifiability.[11]

At the next step, we systematically reviewed the SCOPUS, PUBMED, PsycINFO, and Web of Science databases to find studies on barriers to postoperative pain management in dementia to deductively develop the generated item pool. Totally, eight relevant English-language documents published between 2000 and 2020 were found, coded, and the resulting codes added to the primary item pool.

Integration of qualitative and literature reviews phases

The codes and items extracted from the literature were added to those that emerged from the qualitative study, and a common item pool was created. The item pool was rechecked by the research team, duplicates were removed, similars were merged, and some items were modified. Finally, 67 items remained in the first draft of the instrument.

Second phase: Psychometric evaluation

The initial draft of the instrument was then modified and developed through face, content, construct, convergent and divergent validity, and reliability assessment.

Face validity assessment

Face validity was measured considering both the qualitative and quantitative approaches. To this end, 10 nurses were asked to share their opinions on the readability, wording, difficulty, relevance, and ambiguity of each item. Their suggestions were applied to the related items. The same nurses were then asked to comment on the importance of each item using a five-point Likert scale ranging from "5: absolutely important" to "1: not important." After calculating the mean importance of each item and the frequency of nurses who rated an item as 4 or 5, we calculated the impact scores of the items using the following formula: Item Impact Score = Importance (%) × Frequency

Content validity assessment

In the qualitative content validity assessment, 10 experts in nursing education, psychometry, qualitative studies, and clinical job assignment were asked to review the

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scale and share their recommendations. Their comments were applied. Then, the experts were invited to rate each item's essentiality (as essential, useful but not essential, or unessential) and relevance (as not relevant, somewhat relevant, quite relevant, and very relevant). Then, the content validity index (CVI) of each item was determined based on Lawshe's table (1975).[12] Accordingly, items with a CVI ≥0.62 were accepted. The CVI was calculated by dividing the number of experts who rated an item as 3 or 4 by their total number.[13] Items with a CVI >0.79 were accepted.[14]

Construct validity assessment

Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to assess the construct validity of the BPPMDS. A cross-sectional study was carried out on a convenient sample of 450 nurses, of whom 230 and 220 ones were used for the EFA and CFA, respectively. Inclusion criteria included at least a bachelor's degree in nursing, work experience in surgical wards and intensive care units, and experience of caring for older adults with dementia after HF surgery [Table 1].

The Kaiser-Meyer-Olkin (KMO) test for sample adequacy was used to determine the fitness of the data. Bartlett's test of sphericity was then applied to ensure that the items in the instrument were sufficiently correlated. Factors with eigenvalues ≥1 were considered significant. Latent factors were extracted using Principal Axis Factoring, Varimax Rotation, and Scree Plot. Item communalities <0.4 were removed. Then, the extracted factors were evaluated through CFA. Acceptable model fit is indicated by: Parsimonious comparative fit index (PCFI) and Parsimonious normed fit index (PNFI) (>0.5), comparative fit index (CFI) and incremental fit index (IFI) (>0.9), Root Mean Square Error of Approximation (RMSEA) (<0.08), and Chi-square/degree-of-freedom ratio (χ^2/df) (<3 good, <5 acceptable).[15]

Convergent and divergent validity assessment

The convergent and divergent validity of the BPPMDS were evaluated based on the Fornell and Larcker approach. The following criteria must be satisfied to ensure convergent validity: Composite reliability (CR) >0.7, average variance extracted (AVE) >0.5, and CR > AVE. Moreover, the maximum shared squared variance (MSV) and Average Shared Square Variance (ASV) must be less than AVE to confirm divergent validity.[16] The significance level was set at $P < 0.05$ for all tests.

The normal distribution of the data was tested by handling the single-and multivariable distribution of the data and the outlier data separately. The multivariable outlier data were analyzed using the Mahalanobis d-squared ($P < 0.001$) and Mardia's coefficient of multivariate kurtosis >8.[17] The percentage of missing data was assessed using the multiple imputation method and was then replaced by the mean response given by the participants.

Table 1: Demographic characteristics of the participants

Variable	*n* (%)
Sex	
Female	350 (77.8)
Male	100 (22.2)
Age (years)	
<25	47 (10.4)
25-35	179 (39.9)
36-45	141 (31.3)
>45	83 (18.4)
Marital status	
Single	145 (32.2)
Married	305 (67.8)
Level of education	
BSc	355 (78.9)
MSc	95 (21.1)
Work experience (years)	
<5	74 (16.5)
5-10	110 (24.4)
10-15	101 (22.4)
15-20	93 (20.7)
>20	72 (16)
Experience of acute pain	
Yes	347 (77.1)
No	103 (22.9)
Experience of surgery	
Yes	279 (62)
No	171 (38)

ICU: Intensive care unit, CCU: Critical care unit

Reliability assessment

The reliability of the BPPMDS was evaluated using its internal consistency and stability. Internal consistency was assessed by calculating Cronbach's alpha and McDonald's omega coefficients in a sample of 450 nurses. A reliability >0.7 was considered acceptable. For stability assessment, the scale was completed by 30 nurses with a 2-week interval.

Standard error of measurement

The value of standard error of measurement (SEM) for all subscales and the whole scale was measured, and the Minimal Detectable Change (MDC) and the minimal important change (MIC) were compared to determine final agreement.

Scoring

After determining the weight of each item, the standard 0–100 scoring scale was used. The linear transformation

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formula was applied for convert the scores into a 0–100 scale[18] as shown in the following formula:

x = actual raw score − lowest possible raw score * 100/ possible raw score range

Statistical analysis

The EFA and statistical tests were conducted in SPSS software v. 24.0 (Armonk, NY: IBM Corp), CFA in AMOS v. 24.0, and McDonald's omega coefficient in JASP.

Ethical considerations

This study received approval from the Ethics Committee of Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1398.097). Participants were explained about the study protocols and aims and their written consent was obtained. They were assured about the confidentiality of their information. In the qualitative phase of the study, with the permission of the participants, their voices were recorded. Names of the participants were not mentioned in the study; instead, codes were used in the interview texts.

Results

The results show that most of the participants were female (87/9%). The mean age of the samples was 36.42 ± 7.76 years. Most of the samples were married (74.2%) and had a bachelor's degree (89.4%). The highest work experience was 5–10 (26.1%) and worked in the surgery department (34.5%). The most of samples had no history of acute pain (87%) and no history of surgery (66.4%) [Table 1].

The outcome of the item generation phase

At the end of the item generation phase, an item pool of 75 items was created, 29 of which came from the qualitative phase and 46 from the literature. After merging some items, 67 items entered the psychometric assessments.

Outcome of the psychometric evaluation

Face and content validity

Thirteen items were removed due to having an impact score of ≤1.5. Three items were revised after the qualitative content validity assessment. Nine items were removed for having a CVR <0.62 and 4 for having a CVI <0.79. Finally, 41items remained for construct validity assessment.

Construct validity

The sampling adequacy index was 0.879, and the results of Bartlett's test were significant (df = 741; x^2 = 9148.396; $P \leq 0.001$). After applying the Principal Axis Factoring and varimax rotation, three factors with eigenvalues >1 were extracted. These factors were labeled "older adult-related factors," "health care provider-related factors" and "system-related factors."

The three extracted factors cover 57.572% of the total variance of pain management barriers among older adults with dementia after HF surgery [Table 2]. After varimax rotation, the items of "nurses' reluctance to administer prescribed painkillers to older patients (especially those with dementia or delirium) due to fear of overdose" and "attitude that older adults would die anyway" were removed due to factor loading <0.4.

In CFA, the initial model was not fit, however, the Chi-square goodness-of-fit was adequate after model justification and drawing the correlation between the measured errors. We then calculated other indices (PCFI = 0.836, PNFI = 0.78, CMIN/DF = 1.959, RMSEA = 0.064, IFI = 0.923, and CFI = 0.901), and all confirmed the fitness of the final model. According to the final model of the factorial structure of BPPMDS, correlation was found between the measurement errors of e4/e6, e14/e16, e19/e25, and e33/e35 [Table 3 and Figure 1].

Convergent and divergent validity

The AVE of all factors was >0.5 (0.51–0.70). The AVE of each factor was also greater than its ASV (0.41–0.48) and MSV (0.4–0.51). The BPPMDS construct showed acceptable convergent and divergent validity [Table 4].

Reliability

The Cronbach's alpha and McDonald's omega coefficients were >0.7 for all BPPMDS items, and the overall Cronbach's alpha coefficient was 0.656. The scores achieved in the test retest were compared using the Intraclass Correlation Coefficient (ICC), and the results showed a significant correlation (P < 0.001). The overall ICC index of the whole instrument was 0.923 [Table 5].

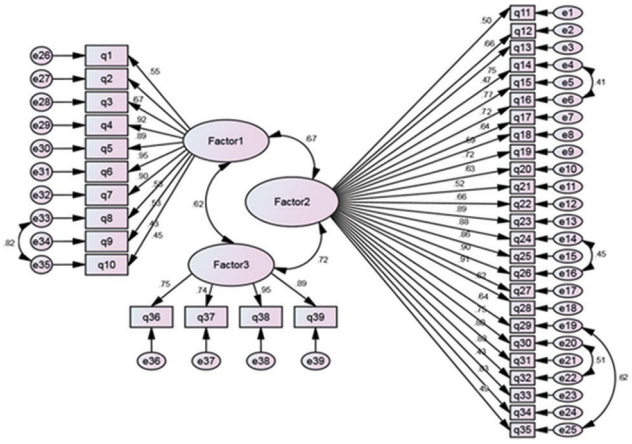

Figure 1: BPPMDS construct: modified model of confirmatory factor analysis. BPPMDS: Barriers to postoperative pain management in dementia scale

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Table 2: Factor loading of Barriers to Postoperative Pain Management in Dementia Scale items calculated by varimax rotation method

Factors/items	Reliability of each item with subscales and total score				Factor loading
	Elderly related	Health care providers related	System related	Total scale	
Elderly-related factors					
1. Cognitive problems (e.g., delirium, restlessness and judgement disorders)	0.731	0.652	0.758	0.826	0.637
2. Not reporting the pain to nurses	0.698	0.693	0.721	0.758	0.543
3. Verbal and contacting disorders (e.g., wording or pronouncing problems)	0.728	0.798	0.701	0.869	0.813
4. Physical problems (e.g., hearing and vision problems)	0.652	0.693	0.703	0.721	0.809
5. Unwillingness for taking painkillers due to fear from side effects like drug-dependency or constipation	0.751	0.712	0.758	0.796	0.655
6. Unwillingness for expressing the pain, so that the nurse doesn't get distracted	0.674	0.683	0.693	0.725	0.667
7. Mood changes like depression or anxiety	0.779	0.805	0.821	0.865	0.779
8. Cultural differences like dialect, beliefs and religious beliefs	0.850	0.856	0.842	0.878	0.759
9. Contrast between the pain severity report of elderly and his family members	0.630	0.655	0.659	0.700	0.741
10. Resisting against taking oral medicines	0.751	0.727	0.778	0.793	0.750
Healthcare providers-related factors					
11. Lack of time for applying nonpharmacological pain revealing treatments (e.g., cold compress or patient repositioning by the nurse)	0.695	0.706	0.685	0.779	0.490
12. Contrast between the knowledge of nurses about providing PRN medicines	0.729	0.710	0.736	0.773	0.454
13. Unawareness about the real pain severity due to lack of time for using pain assessment instruments	0.751	0.725	0.695	0.758	0.482
14. Lack of access to physicians for reporting pain assessment and treatment results	0.602	0.628	0.691	0.685	0.646
15. Ignoring the physician's orders of providing PRN painkillers for older patients	0.826	0.875	809	0.869	0.793
16. Improper interaction between the nurse and patient	0.863	0.802	0.856	0.890	0.790
17. Nurse's distrust of the effectiveness of prescribed painkillers	0.726	0.689	0.732	0.798	0.784
18. Nurse's unawareness of elderly's pain tolerance threshold	0.706	0.653	0.703	0.699	0.451
19. Nurse's fear from painkiller's side effects	0.901	0.926	0.873	0.899	0.801
20. Physicians disregard for nursing staff reports and recommendations about the pain severity or the effect of prescribed painkillers	0.832	0.826	0.840	0.856	0.715
21. Unawareness about painkiller's instructions and needed consumption cautions	0.702	0.751	0.766	0.780	0.638
22. Ignoring the documentation of pharmacological and nonpharmacological intervals in a written format accessible for other nurses or caregivers	0.698	0.711	0.739	0.725	0.647
23. Ignoring the elderly's pain assessment in special conditions (e.g., sudden movements of patient repositioning during night or physiotherapy sessions)	0.923	0.956	0.902	0.936	0.870
24. Ignoring the pain continuity symptoms (e.g., blood pressure increase, surgery site bleeding, increase of heart rate, arrhythmia or blood glucose increase)	0.896	0.835	0.875	0.893	0.874
25. Not following the outcomes of pharmacological interventions	0.785	0.762	0.796	0.788	0.796
26. Ignoring the assessment of physical factors affecting the pain (e.g., full bladder, urinary tract infection or constipation)	0.923	0.910	0.932	0.956	0.878
27. Nurses disregard for patient's requests for painkillers	0.904	0.883	0.926	0.930	0.872
28. Ignoring the application of dose-equivalent table (e.g., for converting mEq to mL or estimating the new consumption doses in case new narcotics are prescribed)	0.632	0.601	0.626	0.623	0.592
29. Physician's unwillingness for prescribing new painkillers	0.736	0.744	0.731	0.764	0.801
30. Not using several pain management solutions (e.g., educating the patient/family members or using pharmacological/nonpharmacological interventions)	0.926	0.940	0.912	0.962	0.814
31. Not asking the family caregivers about the behavioral changes resulted by elderly's pain (e.g., ignoring requests, turmoil or facial expressions change)	0.881	0.876	0.837	0.893	0.814
32. Ignoring the behavioral changes resulted by pain relief (e.g., anger, ignoring the treatment team's requests or movement disorders)	0.914	0.893	0.890	0.923	0.856
33. Delayed pain examination	0.620	0.642	0.653	0.681	0.563

Contd...

Table 2: Contd...

Factors/items	Reliability of each item with subscales and total score				Factor loading
	Elderly related	Health care providers related	System related	Total scale	
34. Ignoring the usage of pain assessment common questions for older patients (e.g., asking do you feel comfortable/uncomfortable instead of have you pain?)	0.855	0.863	0.876	0.887	0.860
35. Unclear physician's instructions for the consumption of requested painkillers	0.709	0.732	0.713	0.755	0.695
System-related factors					
36. Lack of organized caring system for searching through main painkillers and providing the medicines	0.631	0.628	0.678	0.669	0.501
37. Shortage of comforting equipment (e.g., warm/cold packs, mattresses and chairs as the alternatives to pain killing medicines)	0.636	0.643	0.635	0.690	0.569
38. Lack of certain instructions for the use of most appropriate pain management techniques	0.730	0.764	0.701	0.756	0.720
39. Lack of valid instruments for assessing pain among the older patients with dementia after a HF surgery	0.823	0.863	0.841	0.884	0.724

HF: Hip fracture

Table 3: Fit indices of the confirmatory factor analysis of the Barriers to Postoperative Pain Management in Dementia Scale

CFA index	χ^2	DF	*P*	CMIN/DF	RMSEA	PNFI	PNFI	PCFI	IFI	AIC
Primary model	1965.397	699	0.001	2.812	0.09	0.68	0.751	0.672	00.791	1241.34
Secondary model	1360.083	694	0.001	1.959	0.064	0.78	0.901	0.836	0.923	954.26

Fit indices: PNFI, PCFI (>0.5), CFI, IFI (>0.9), RMSEA (>0.08), CMIN/DF (<3 good, <5 acceptable). OPPMDS: Obstacles to postoperative pain management in dementia scale, CMIN/DF: Chi-square/degree-of-freedom ratio, RMSEA: Root mean square error of approximation, PCFI: Parsimonious comparative fit index, AIC: Akaike information criterion, PNFI: Parsimonious normed fit index, IFI: Incremental fit index, CFI: Comparative fit index, CFA: Confirmatory factor analysis

Table 4: Convergent and divergent validity of Barriers to Postoperative Pain Management in Dementia Scale

Factor	ASV	MSV	AVE
Elderly-related factors	0.416	0.448	0.510
Healthcare providers-related factors	0.483	0.518	0.523
System-related factors	0.451	0.518	0.701

ASV: Average shared square variance, MSV: Maximum shared squared variance, AVE: Average variance extracted

Regarding the SEM, the results showed that the value of MDC was greater than MIC [Table 6].

Scoring

The final edition of the BPPMDS includes 39 items in three factors of elderly-related factors (10 items), healthcare provider-related factors (25 items), and system-related factors (4 items). A five-point Likert scale was used to quantify the items (5: highly agree, 4: agree, 3: no comments, 2: disagree, and 1: highly disagree). The total scale score ranges from 39 to 195.

Discussion

In this study, inductive and deductive methods were used for item generation. The combination of these methods is introduced as the most appropriate technique for this purpose.[19] In addition to the fact that the nurses confirmed the wording and clarity of the items, the impact scores of all items were >1.5, indicating the face validity of the BPPMDS items.[20] Furthermore, the experts panel reviewed the grammar, wording, item allocation, and scaling of the instrument. The experts' comments were also used to calculate the CVR and CVI of the BPPMDS, and the results showed that the scale has acceptable CVR and CVI. It is believed that two points need to be considered when examining content validity: The first is to ensure that the most relevant and appropriate items are selected, and the second is to design the items in the most appropriate form. The former is referred to as CVR and the latter as CVI.[21]

We conducted EFA and CFA to examine the construct validity of the BPPMDS. Factor analysis is a well-known method for categorizing the items into factors (subscales).[22] The results of KMO and Bartlett's tests showed the adequacy of the sample for conduction factor analysis. KMO values of 0.7–0.8 are considered adequate and 0.8–0.9 as highly adequate.[23] The results of CFA (i.e., RMSEAR, CFI, NFI, and Chi-squared values) also confirmed the fitness of the model.[21,24]

The results show good internal consistency or reliability based on the acceptable value of Cronbach's alpha for the whole instrument. Conventionally, this coefficient must

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Table 5: Reliability of Barriers to Postoperative Pain Management in Dementia Scale (intraclass correlation coefficient and stability)

Factor	Number of the items	ICC	CI 95%	*P*	CR	α	Ω
Elderly-related factors	10 (Q1-Q10)	0.705	0.655-0.750	<0.001	0.906	0.891	0.878
Healthcare providers-related factors	25 (Q11-Q35)	0.924	0.911-0.935	<0.001	0.963	0.929	0.934
System-related factors	4 (Q36-Q39)	0.860	0.834-0.883	<0.001	0.902	0.890	0.901
Total	39 (Q1-Q39)	0.923	0.908-0.936	<0.001		0.956	

CI: Confidence interval, ICC: Intraclass correlation coefficient, CR: Composite reliability

Table 6: Comparing standard error of measurement, minimal detectable change, and minimal important change values for Barriers to Postoperative Pain Management in Dementia Scale

Factor	Range of scores	SEM	MDC	MIC	Agreement
Elderly-related factors	27-50	2.49	6.92	1.03	Positive
Healthcare providers-related factors	39-130	4.64	12.88	3.86	Positive
System-related factors	5-20	1.42	3.96	0.625	Positive
Total	82-199	5.84	16.19	4.20	Positive

SEM: Standard error of measurement, MDC: Minimal detectable change, MIC: Minimal important change

be >0.7.[25] The stability of the scale was also measured through test-retest and ICC methods. A previous study confirmed these methods for measuring the reliability of a scale.[26] The strengths of this study include the relatively large sample size, sampling from different hospitals in different cities, the use of a sequential, exploratory mixed-methods design, and inductive and deductive methods to generate items. However, there are some limitations in this study. The BPPMDS is a self-report scale and has all the limitations of a self-report instrument. The geographically-limited sample is itself a limitation, as social, cultural, and regional factors may influence participants' experiences and therefore, the formation of the scale items. Hence, further studies are needed to confirm the validity and reliability of this instrument in different cultural contexts. Similar studies are also suggested to examine how older patients view barriers to postoperative acute pain management.

Conclusions

The BPPMDS is a valid and reliable 39-item instrument which includes three subscales: older adults-related factors, health care providers-related factors, and system-related factors. This scale can be used as a valid and reliable instrument to measure postoperative acute pain management in older adults after any fracture or surgery because the items designed are not specific to patients with HFs. Nursing managers can use the BPPMDS to understand barriers to pain management in acute care units.

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Conflicts of interest

There are no conflicts of interest.

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