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Original Article

Psychometric Properties of Pain Intensity Scales in Isfahanian Geriatric Population

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Introduction: Given the importance of pain assessment in the older adults, instrumentation for pain measurement is inevitable. The aim of this study is to compare psychometric properties of three commonly used pain intensity scales; (Numeric Rating Scale , Verbal Descriptor Scale (VDS) and, Faces Pain Scale Revised (FPS-R)) in Isfahanian older adults, to identify the most validated and reliable scale.

Methods: This was a methodological study on 60 cognitively intact older people in Isfahan in 2017, selected through convenience sampling. First, the worst pain of life and then pain intensity in general, at rest and immediately after the movement of upper and lower limbs was measured using all three scales. The data was analyzed by SPSS 20 using Spearman's rank correlation coefficient, Kendall's coefficient of concordance (W) and Chi-square tests.

Results: Based on the results, there was no significant differences between FPS-R and VDS in terms of preference ($p = 0.506$) and simplicity ($p = 0.647$). Finding showed significance and convergent validity, and reliability of all three tests ($p < 0.05$).

Conclusion: All three pain assessment tools adequately demonstrated reliable validity to measure pain in isfahanian older adults. Accordingly, hence probable limited generalizability of the results, nurses and other health care team could be recommended to use the pain assessment tools specially VDS for pain assessment in old people.

Keywords: Cognitive, Aging, Pain Measurement, Psychometrics

Introduction

Ageing phenomenon is a natural process of life (1, 2). Geriatric people often suffer acute and chronic painful diseases and have to take multiple analgesics (3, 4). Persistent pain in older people is associated with functional impairment, falls, slower rehabilitation, depression, anxiety, decreased social activity, sleep disturbance and increased use of health care and high costs. Measuring pain in the older people is very important and poses a challenge for researchers and also health professionals because the best tool for the elderly is not specified (3-6).

One reason for prevalent poor pain management in geriatric patients is inappropriate pain assessment and measurement (6, 7). Pain assessment tool is a common language for expressing patients' pain to their caregivers (8, 9). All the three Numeric Rating Scale (NRS), Verbal Descriptor Scale (VDS) and Faces Pain Scale–Revised (FPS-R) have been recommended to assess pain in the elderly (10-13). There are some inconsistencies in the literature on best pain assessment tool. In one study, FPS-R was reported to be the poorest tool and VDS was mainly selected for assessment of pain intensity among older people with mild to moderate cognitive impairment (14). In a study in China, FPS was the best tool in terms of

rating, validity and reliability followed by VDS; half the patients stated that it was easier and less erroneous (13). In another research, pain intensity was studied in three modes (overall assessment, at rest, during movement) through NRS and VDS scales. The results showed that 94.8% and 100% of the older people were able to make judgments with NRS and VDS, respectively (5). Studies have revealed that older people with cognitive impairment are more likely to be able to complete VDS than NRS or FPS-R (4). There is evidence, even though not conclusive, that VDS is better than NRS with respect to respondent preference, completion rates, sensitivity, and reliability. On the other hand, some argue in favor of widespread use of NRS that it has more reliability and validity in the general population. Lack of consensus about the applying of scales and the fact that physicians and patients assess pain intensity scores differently even on one scale have sometimes led to the use of two types of scales (6).

In general, pain assessment is an effective prerequisite for pain management (10, 13). Pain relief is a moral issue for nurses (9). Because of cultural differences, physicians, nurses and researchers need to validate pain assessment tools for their own communities to ensure quality pain assessment (14). This study, therefore, aims to determine and compare validity and reliability of pain intensity scales in the older people in Isfahan, Iran.

Methods

Study design

This research is a methodological study conducted in Shariati Hospital and Day Center of the Ranginkaman Sapid of Isfahan, Iran. Convenience sampling selection criteria: Age 60 or older in community-dwellers, having skeletal or muscular pain, having a tendency to express pain, ability to converse in Persian, lack of cognitive impairment, and mental illness, blindness and deafness.

The participants were unaware of the NRS, VDS, and FPS-R pain intensity scales and had not previously filled a pain intensity report related to any disease. But they were given enough information to know how to complete the scales at the beginning of the research. Their cognitive status in terms of time and space awareness and their cognitive function were measured through the Persian version of Mini-Mental State Examination. The older person enrolled in the study had appropriate cognitive status to participate in the study (scored more than 25).

Pain assessment tools were NRS, VDS, FPS-R. The validity and reliability of its Persian version have been confirmed in general population in various studies. NRS is a self-report pain scale to assess pain intensity and ask individual to point to the number that best represents the intensity of their pain. Verbal VDS is used to assess pain intensity in persons who are able to self-report. In this scale ask the older adult to point to the words to show how bad or severe their pain is right. The FPS show how much pain or discomfort one is feeling. The face on the left shows no pain. Each face shows more and more pain up to the last face that shows the worst pain possible (15, 16).

First, the worst pain of life such as toothache, childbirth, headache, etc. was measured using the scales. Then, pain intensity in general, at rest and immediately after the movement of upper and lower limbs was measured using all three scales. Each interview lasted 10 to 15 minutes on average. Face validity of NRS, VDS, and FPS-R tools was examined by three aspects of preference (Scale Preference Questionnaire (SPQ), simplicity (Scale Simplicity Questionnaire (SSQ), and accuracy (Scale Accuracy Checklist (SAC), and Convergent validity was examined. In other words in this study to determine the validity used convergent validity of pain scales and criterion validity (sensitivity to change over time). Spearman's rank correlation coefficient was used to determine and compare the convergent validity of pain scales. Chi-square test was also used to determine the criterion validity (sensitivity to change over time) of the scales. Kendall's coefficient of concordance (W), which is the normalized form of Friedman test as an agreement coefficient, was used to determine the reliability of pain scales. In this test, each respondent is considered as a judge or rater, and each item is considered as a variable and then the average ranks are calculated for each of these variables. This test considers the difference in these averages by comparing the average ratings among variables. Kendall's W fluctuates between 0 and 1, where values close to 0 indicate less agreement and values close to 1 show more agreement among respondents on the variables of interest. The SPQ, SSQ and SAC scales were used to determine and compare the frequency of preferred pain scale in the older people in terms of age, sex and education. The SAC scale was used to determine and compare the frequency of response error between the pain scales in the older people in terms of demographic characteristics.

Ethical considerations

This research was project no. 4909 supported by the Deputy of Research of Shahid Sadoughi University of Medical Sciences in Yazd, Iran. In order to observe ethical considerations; the project was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences in Yazd by the letter no. P/17/1/206517 dated Dec. 6, 2016. Also, informed written consent was obtained from each participant.

Statistical analysis

Afterwards, the data was analyzed by SPSS 20 using Spearman's rank correlation coefficient, Kendall's coefficient of concordance (W) and chi-square statistical tests ($p < 0.05$).

Results

A number of eligible 60 older people from Shariati Hospital and Day Center of the Ranginkaman Sapid for Older People in Isfahan participated in this study whose demographic profile is represented in table 1.

Quantitative face validity of NRS, VDS, and FPS-R pain scales was examined and compared by the three aspects of preference, simplicity, and accuracy. (Table 2)

The highest preference, simplest scale, and greater number of accurate responses reflect higher face validity.

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Table 1. Demographic profile of the participants

Demographic characteristics		Frequency	Percent
Age (year)	60 - 70	50	83.3
	71 - 80	8	13.3
	> 80	2	3.3
Sex	Male	28	46.7
	Female	32	53.3
Education	Illiterate	25	41.7
	Less than high school diploma	25	41.7
	High school diploma and associate degree	7	11.7
	Master's and higher	3	5.0
Job	Retired	28	46.7
	Unemployed	2	3.3
	Other	30	50.0
Marital status	Married	45	75.0
	Single and divorced	1	1.7
	Widowed	14	23.3

Table 2. Face validity of NRS, VDS and FPS-R tools by SPQ, SSQ and SAC scales

		FPS-R	VDS	NRS	p-value
Scale preference	Least preference	14 (23.3)	9 (15.0)	36 (60.0)	FPS - R&VDS = 0.506
SPQ	Medium preference	21 (35.0)	24 (40.0)	16 (26.7)	FPS - R&NRS < 0.001
	Most preference	25 (41.7)	27 (45.0)	8 (13.3)	VDS&NRS < 0.001
Scale simplicity					
SSQ	Least simplicity	14 (23.4)	10 (16.7)	35 (58.3)	FPSR&VDS = 0.647
	Medium simplicity	23 (38.3)	24 (40.0)	14 (23.3)	FPSR&NRS < 0.001
	Most simplicity	23 (38.3)	26 (43.3)	11 (18.3)	VDS&NRS < 0.001
Accuracy and validity					
SAC	Error	14 (23.3)	10 (16.7)	38 (63.3)	< 0.001
	Without error	46 (76.7)	50 (83.3)	22 (36.7)	

NRS= Numeric Rating Scale, VDS= Verbal Descriptor Scale, FPS-R= Faces Pain Scale–Revised
SPQ= Scale Preference Questionnaire, SSQ= Scale Simplicity Questionnaire, SAC= Scale Accuracy Checklist

The results show that content validity for the highest preference with SPQ scale and for maximum simplicity with SSQ scale in the FPS-R tool is 0.53. These two indices were 0.70 and 0.83 for VDS and 0.20 and 0.42 for NRS, respectively. Accordingly, the best and worst indices related to the preference and simplicity was for VDS and NRS. It should be noted that preference and simplicity indices related to FPS-R and VDS had no significant difference, but they were significantly different from those of NRS. Convergent validity of NRS and VDS was measured by VDS. In most cases, p - value was under 0.005 which indicated significance. Accordingly, convergent validity of all three tests was confirmed. (Table 3)

The only exception was for the convergence of NRS with VDS with p = 0.086 for the least pain measured in the past 24 hours (in the first week).

To determine the criterion validity (sensitivity to change over time) of pain scales, the convergent validity of the scales was measured by VDS, as the standard scale, as shown in table 3. In most cases P - value became under 0.001 which indicates significance. The convergent validity of all the three tests was thus confirmed. Criterion validity is confirmed because of the high correlation between the scales. Criterion validity shows the correlation or consistency between scores of one test and those of another test called the criterion. The higher the correlation coefficient (the correlation between predictor test score and criterion score), the greater the validity also is expected.

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Table 3. Convergent validity of pain scales

Spearman's rho			Beginning of the study		First week		Second week	
			FPSR	NRS	FPSR	NRS	FPSR	NRS
The worst pain of life	VDS	Coefficient	0.453	0.300	0.437	0.481	0.581	0.511
		p - value	< 0.001	0.20	< 0.001	< 0.001	< 0.001	< 0.001
Current pain score	VDS	Coefficient	0.774	0.623	0.638	0.503	0.688	0.612
		p - value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
The worst pain in the past 24 hours	VDS	Coefficient	0.537	0.638	0.598	0.599	0.662	0.679
		p - value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
The least pain in the past 24 hours	VDS	Coefficient	0.676	0.429	0.608	0.224	0.614	0.359
		p - value	< 0.001	< 0.001	< 0.001	0.086	< 0.001	0.005
The average pain in the past 24 hours	VDS	Coefficient	0.508	0.281	0.642	0.297	0.457	0.284
		p - value	< 0.001	0.030	< 0.001	0.021	< 0.001	0.028
Pain at rest	VDS	Coefficient	0.693	0.646	0.547	0.568	0.667	0.677
		p - value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Pain in limb movement	VDS	Coefficient	0.685	0.435	0.589	0.564	0.638	0.518
		p - value	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001

On determining the reliability, equivalence or equilibrium of pain scales in the older people, the assessment results of the worst pain of life, current pain, the worst pain in the last 24 hours, the least pain in the past 24 hours, the average pain intensity in the past 24 hours, pain at rest, and pain during limb movement obtained by NRS, VDS, and FPS-R tools in three stages and over three weeks showed no significant difference between the responses by Kendall's W Test ($p > 0.005$). This indicates reliability of the scales. The exceptions are for the average pain intensity during the past 24 hours for NRS with $p = 0.059$ and VDS with $p = 0.025$, pain at rest for VDS with $p = 0.024$, and pain during limb movement for NRS with $p = 0.002$ which indicate a significant difference and thus non-reliability of these scales.

Discussion

On the finding all three pain assessment tools had adequate reliability and validity on older people, best was VDS followed by FPS-R and NRS. A study conducted in China aimed to compare the psychometric properties of five pain intensity scales including NRS, VDS, FPS, numeric box-21 scale (BS-21) and color analog scale (CAS) after surgery in adults with different ages including older people with mild or average cognitive impairment (CI), this findings supported the psychometric properties of all five pain scales for pain assessment in Chinese adults including elderly with mild CI. However, the FPS appears to be the best, followed by the VDS and the NRS (13). The results are consistent with those of this study but the best tool was different.

Based on face validity results of the study, FPS showed the most preference and simplicity and the least incorrect answers (13). However, convergent validity of all three tests was confirmed in this study. In this regard, Pereira et al. conducted a study in Brazil on NRS and VDS tools in older people to identify the preference of one scale. They showed that there is a significant relationship between the average scores of NRS and VDS which indicated convergent validity between the two scales (5). Another study aimed to compare the psychometric properties of five pain intensity scales including NRS, VDS, FPS, BS-21 and CAS after surgery in adults with different ages including older people with mild or average cognitive impairment, The results are similar with those of this study in that convergent validity of all the five pain scales was confirmed in each group (13). It should be noted that the elderly studied had a different cognitive status. Also, a prospective study was conducted on 173 Chinese patients to assess postoperative pain with the four visual analogue scales (VAS), NRS, VDS and FPS-R tools (15). The results are also consistent with those of the present study; convergent validity of all four pain scales was strongly supported in each group (15).

The psychometric properties of NRS, VDS, FPS and the Iowa Pain Thermometer tools were studied in the older people with and without cognitive impairment. The results reported good up to very good convergent validity of the scales (16, 17). Based on the results this study, VDS ranked higher in terms of preference and simplicity followed by FPSR and NRS.

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Our results were also in consistency with institutionalized older people. For instance, a study in the Federal University of Goiás was conducted on NRS and VDS tools to identify the preference of one scale for 101 older people living in a nursing home (5). Pain intensity in general, at rest and for the duration of movement as measured with NRS and VDS showed that 94.8% of the elder individuals were able to make decisions with NRS and 100% were able to make judgments with VDS. However, the intended scale for older people, regardless of sex, was VDS (5). A further research in the Oxford University in the US on NRS and VDS tools examined on 3676 residents of nursing homes concluded that VDS is better than NRS with respect to respondent preference, completion rates, sensitivity, and reliability (6). In another study in the College of Nursing, University of Iowa, the psychometric properties and pain intensity were assessed by VAS, NRS, VDS, visual numeric scale and FPS tools showed the scale most preferred to represent pain intensity in both cohorts of subjects was the NRS, followed by the VDS and scale preference was not dependent on cognitive status, education level, age, race or sex (12). A comparative-descriptive study examined psychometric properties of pain intensity scales among postoperative adults and older patients with or without mild cognitive impairment in China declare the results FPS ranked first in terms of validity and reliability followed by VDS and FPS was considered simpler and less erroneous by half the patients (13). Another study assessed FPS-R, VDS and NRS to determine the reliability and validity of these tools (18). This may be due to the presence of cognitive impairment in the elderly.

Conclusion

The results of the study showed that although psychometric properties of NRS, VDS and FPS-R tools are valid and reliable, face validity of VDS was higher than other scales and it was the best choice for community-dwelling Isfahanian elderlies, followed by FPS-R and NRS.

Study limitations

Non-cooperation of some of the older adults living in the nursing homes due to impatience, sickness, irritation, etc. was a limitation of this study. Also, as the participants were only from a specific geographic location, the generalizability of results is may be limited.

Conflict of interest

The authors declare that there is no conflict of interest in this study.

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Authors' contribution

Study design: Khadijeh Nasiriani, Saeed Nasri Nasrabadi.

Data collection and analysis: Khadijeh Nasiriani, Somayeh Kahdoui, Saeed Nasri Nasrabadi.

Manuscript preparation and editing: Khadijeh Nasiriani, Saeed Nasri Nasrabadi.

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