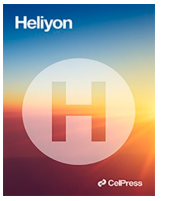
Heliyon 9 (2023) e18111

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Investigating the validity and reliability of the GLFS-25 questionnaire by factor analysis in the elderly hospitalized at the intensive and cardiac care units

Hamid Taghinejad [a], Elham Mohammadyari [b], Hamed Tavan [c,*], Anis Mohammadyari [c,**]

[a] Dept. of Nursing, Faculty of Nursing and Midwifery, Ilam University of Medical Sciences, Ilam, Iran
[b] Department of Cardiology, School of Medicine, Shahid Mostafa Khomaeini Hospital, Ilam University of Medical Sciences, Ilam, Iran
[c] Faculty of Nursing and Midwifery, Ilam University of Medical Sciences, Ilam, Iran

ARTICLE INFO

Keywords:
Elderly
Locomotive syndrome
Factor analysis

ABSTRACT

Introduction: Geriatric Locomotive Function Scale-25 (GLFS-25) is a 25-item tool most commonly used to diagnose locomotive syndrome in the elderly. The purpose of the present study was to investigate the validity and reliability of the GLFS-25 questionnaire using factor analysis.
Materials and methods: This descriptive-analytical study was conducted on 186 elderly people. The GLFS-25 questionnaire contains 25 items, and each item is scored on a five-point Likert scale from 0 to 4. Data were analyzed by SPSS V.19 software. Descriptive (frequency, percentage, mean, and standard deviation) and inferential (Cronbach's alpha, correlation coefficient, Bartlett test, KMO index, scree plot, and factor analysis) statistics were used to present the findings.
Results: Factor analysis revealed two hidden factors in the four dimensions of the questionnaire (i.e., pain, daily activities, social relations, and mental health). The first factor, named mobility and its consequential concerns), with a variance percentage of 74.323, had an effect on questions No. 19, 11, 25, 16, 6, 24, 5, 4, and 3. The second factor, named the problems and risks associated with daily and social activities, with a variance percentage of 78.680, had an effect on questions No. 17, 22, 7, 18, 14, 20, 13, 9, 12, 8, 10, 21, 2, 15, 1, and 23. Cronbach's alpha coefficient among the questionnaire's dimensions was 78.4%.
Conclusion: The GLFS-25 questionnaire can be used as a valid and reliable tool to diagnose locomotive syndrome in the elderly.

1. Introduction

Locomotive syndrome is a condition in which, due to defects in one or more locomotors organs, the movement function of an elderly person, including standing, sitting, and walking, is disrupted or is going to be compromised in the near future. The severe form

* Corresponding author. Clinical Research Development Unit, Shahid Mostafa Khomeini Hospital, Ilam University of Medical Sciences, P.O. Box: 6939177143, Ilam, Iran.
** Corresponding author. Faculty of Nursing and Midwifery, Student Research Committee, Ilam University of Medical Sciences, PO Box: 69391-77143, Ilam, Iran.
E-mail addresses: hamedtavan@gmail.com (H. Tavan), anis.m1995@yahoo.com (A. Mohammadyari).

https://doi.org/10.1016/j.heliyon.2023.e18111
Received 1 February 2023; Received in revised form 6 July 2023; Accepted 7 July 2023
Available online 11 July 2023

of this syndrome can lead to variable degrees of dependence in performing daily life activities, and consequently, leading to isolation and seclusion. Also, locomotive syndrome can lead to muscular deterioration, loss of balance, pain, and restricted joint or spine functionality [1]. In order to improve the health of the elderly, the World Health Organization (WHO) emphasizes the need for regular exercise, avoiding smoking and alcohol consumption, proper nutrition, and age-adjusted safety measures. Movement restrictions in the elderly generally result in the loss of incentives, deprivation from attending social gatherings, going to natural places, social isolation, feeling incompetent, worthlessness, and depressed. Due to the fact that elderly people generally suffer from several debilitating co morbidities, which increase the per capita costs of treatment and care, the timely prevention and treatment of psychological disorders can improve their quality of life. Therefore, neglecting the health requirements of the elderly may cause irreparable damage to their functioning [2].

Geriatric Locomotive Function Scale-25 (GLFS-25) is the most commonly used tool for monitoring locomotive syndrome in the elderly. This questionnaire contains 25 items and assesses different life dimensions of the elderly (pain, daily activities, social relations, and psychological health). Each item of this tool is scored between 0 and 4 on a five-point Likert scale (from none = 0 to very severe = 4). The final score of the questionnaire is between 0 and 100, and the cut-off point for the diagnosis of locomotive problems in the elderly is 16. So, people acquiring a score of 16 or higher are considered to suffer from locomotive syndrome [3–5].

In a study by Yu Tanabe et al. [6], the researchers conducted the factor analysis of the GLFS-25 tool in the elderly. Here, we used EFA to develop the short form of GLFS-25 (i.e., GLFS-9), which contained nine questions that were originally embedded in the GLFS-25 scale. These nine questions were scored on a 5-point Likert scale, and the total score, ranging from 0 to 36, was used to diagnose grade I (i.e., a of score 3–5) or II (a score $\geq$6) locomotive syndrome, while a score of $\leq$2 indicated no abnormality. We found that GLFS-9 could stratify locomotive syndrome into grades I and II diseases, providing an opportunity for screening and preventing locomotive syndrome [6].

In the study of Kimura et al. [7], who investigated the risk of falling in the elderly using the GLFS-25 tool, out of 360 patients, 61 (16.9%), 31 (8.6%), 4 (1.1%), and 6 (1.7%) people experienced falling in the year following the operation one, two, three, four to five, and six or more times, respectively, while 102 (28%) and 41 (11%) of the elderly experienced falls at least once and twice or more, respectively, in the subsequent years. The mean score of GLFS-25 was obtained as 30.2 $\pm$ 22.7, and 242 (62%) of the participants obtained a score of 16 or higher, fulfilling the full diagnostic criteria of locomotive syndrome. The elderly under study were divided into the two categories of repetitive and non-repetitive falls [7].

According to a forecast by the WHO, 80% of the elderly populations will reside in low- and middle-income countries by 2050, when the rate of population aging will be considerably faster compared to the past. In 2020, people aging 60 years or older exceed the population of<5-year-old children. From 2015 to 2050, the world's elderly population aged 60 years or higher will almost double, reaching 22% from 12% [8].

According to the estimation of the United Nation, the population of the elderly worldwide will surpass one billion by 2050, which necessitates planning for this enormous population to increase their welfare and life expectancy. Currently, the average life expectancy among women is 4.5 years higher than in men [9]. Also, the World Bank's statistics show an increasing trend in the elderly population from 1990 until today, comprising 10% of the world's population [10].

Exploratory and confirmatory factor analysis and Cronbach's alpha coefficient provide useful measures to determine research tools 'construct validity, reliability, and internal consistency. Exploratory factor analysis discloses hidden or unmeasured variables based on their interrelationships and generates hypotheses accordingly, and confirmatory factor analysis assesses the hypotheses related to the construct validity of these variables [11,12]. Considering the increase in elderly populations worldwide, an accurate and comprehensive tool is required to reliably detect movement disorders among these people. Considering that the GLFS-25 questionnaire contains an asymmetrical cut-off point, which is a weakness that has not been addressed so far, we here aimed to assess the validity and reliability of this tool by factor analysis.

2. Materials and methods

This was a descriptive-analytical study conducted on 186 elderly people referring to the special care units (CCU and ICU) of the Shahid Mustafa Khomeini Hospital of Ilam city in 2022. The GLFS-25 questionnaire was used to identify the elderly at risk of locomotive syndrome. The inclusion criterion in this study was admission to special care units (CCU and ICU), and exclusion criteria encompassed the requirement for mechanical ventilation and undergoing limb amputation. After talking with the mentioned elderly and explaining the objectives of the study to them and receiving informed consent, a questionnaire was given to them.

After completing the questionnaire, the data were analyzed by SPSS V.19 software using descriptive (frequency, percentage, mean, standard deviation), and inferential (one-way and two-way analysis of variance, Cronbach's alpha, correlation coefficient, Bartlett's test, KMO sample adequacy index, scree plot, and factor analysis)statistics. The sample adequacy index was interpreted as excellent (for an index above 0.8) or adequate (for an index above 0.7). Bartlett's test was used to check inter-variable correlations. A P value of $<$0.05 was regarded to reject the null hypothesis.

The factor analysis method was used to determine the validity of the questionnaire and its constructs, and the reliability of the tool was checked using the internal consistency (Cronbach's alpha coefficient) method. In order to confirm the reliability of the questionnaire, the final version of the instrument was provided to ten elderly people (who were not among the final participants of the study) twice with one-week interval. Cronbach's alpha method was used to determine the reliability of the questionnaire, showing a correlation coefficient of 0.76. Regarding that the responses provided were close to each other, the reliability of the questionnaire was verified. Most importantly, the content validity of the questionnaire was assessed to determine if it truly diagnosed locomotive syndrome in the elderly patients hospitalized at special care units (ICU, CCU). The construct validity of the instrument was also assessed.

It should be noted that in all stages of the study, compliance with the provisions of the Helsinki and Belmont declarations was considered and the research was ethically approved by the Ilam University of Medical Sciences Ethic Committee (ethic code: IR.MEDILAM.REC.1401.043). It is confirming that informed consent was obtained from all patients/participants for experiments.

3. Results

Out of 186 participants, 106 (57%) were men, and 80 (43%) were women. Ninety-four people (50.5%) had an age between 60 and 74 years old; 54 (29%) aged between 75 and 84 years, and 38 (20.4%) of the participants were older than 85 years.

The results showed that 21 (11.3%) of the elderly had no movement disorders (i.e., a score below 16), while 165 (88.7%) of the participants suffered from locomotive syndrome (i.e., a score of least 16to 100). Table 1 shows correlation coefficients between the dimensions of the questionnaire. Table 2 shows the results of the factor analysis of the GLFS-25 questionnaire.

Fig. 1 shows the scree plot of the GLFS-25 questionnaire, indicating the number of desirable factors. The results of factor analysis revealed two hidden factors within the four dimensions of the questionnaire (i.e., pain, daily activities, social relations, and psychological health). The first hidden factor, named "mobility and its consequential concerns", with a variance percentage of 74.323%, affected questions No. 11, 19, 25, 16, 6, 24, 5, 4, and 3. The second hidden factor, "the problems and risks associated with daily and social activities", with a variance percentage of 78.680%, affected questions No. 18, 7, 22, 17, 14, 20, 13, 9, 12, 8, 10, 21, 2, 15, 1, and 23. Bartlett's test (6.576, $P = 0.000$) verified the opposite hypothesis, and the KMO index (0.970) indicated the adequacy of the sample size. Finally, Cronbach's alpha correlation between the questionnaire's dimensions was obtained as 78.4%.

4. Discussion

The aim of this study was to investigate the validity and reliability of the GLFS-25 questionnaire by factor analysis. The present study showed that the GLFS-25 questionnaire could be used as a valid and reliable screening tool for locomotive syndrome among the elderly. In the present study, Cronbach's alpha coefficient of the GLFS-25 questionnaire was higher than 75, indicating that the questionnaire had satisfactory internal consistency to be used in an elderly population. The variance of the tool's factors confirmed the theoretical and main constructs of the questionnaire. The values of residual and measured errors were low (these types of errors are inherent to some extent to all research instruments and are independent of background hidden constructs) [11–13]. In general, these low residual values confirmed the reliability and validity of the instrument despite the fact that the tool's questions were subjective, meaning that if it is used on different occasions, it will provide the same results. Finally, the high correlation coefficients between items in each factor indicated that they were relevant to each other [11–13].

5. Conclusion

The GLFS-25 questionnaire can be used as a valid and reliable screening tool for locomotive syndrome in the elderly. This

Table 1
Correlation between different dimensions of the Geriatric Locomotive Function Scale-25 questionnaire.

	GLSF-25	Pain	Activity	Social	Mental	Total
Pain	Pearson Correlation	1	.881**	.764**	.793**	.909**
	Sig. (2-tailed)		.000	.000	.000	.000
	Sum of Squares and Cross-products	1.979E3	8.448E3	1.621E3	1.073E3	1.312E4
	Covariance	10.698	45.664	8.764	5.802	70.928
	N	186	186	186	186	186
Activity	Pearson Correlation	.881**	1	.842**	.884**	.992**
	Sig. (2-tailed)	.000		.000	.000	.000
	Sum of Squares and Cross-products	8.448E3	4.644E4	8.651E3	5.790E3	6.933E4
	Covariance	45.664	251.011	46.760	31.295	374.731
	N	186	186	186	186	186
Social	Pearson Correlation	.764**	.842**	1	.832**	.889**
	Sig. (2-tailed)	.000	.000		.000	.000
	Sum of Squares and Cross-products	1.621E3	8.651E3	2.273E3	1.207E3	1.375E4
	Covariance	8.764	46.760	12.284	6.522	74.331
	N	186	186	186	186	186
Mental	Pearson Correlation	.793**	.884**	.832**	1	.912**
	Sig. (2-tailed)	.000	.000	.000		.000
	Sum of Squares and Cross-products	1.073E3	5.790E3	1.207E3	924.629	8.994E3
	Covariance	5.802	31.295	6.522	4.998	48.618
	N	186	186	186	186	186
Total	Pearson Correlation	.909**	.992**	.889**	.912**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	Sum of Squares and Cross-products	1.312E4	6.933E4	1.375E4	8.994E3	1.052E5
	Covariance	70.928	374.731	74.331	48.618	568.607
	N	186	186	186	186	186

**. Correlation is significant at the 0.01 level (2-ailed).

Table 2
Factor analysis of the Geriatric Locomotive Function Scale-25 questionnair.

Factor	question	Name	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
			Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	19-11-25-16-6-24-5-4-3	Moving and worrying about the consequences	74.323	74.323	18.581	41.418	41.418	10.354	74.323	74.323	18.581
2	17-22-7-18-14-20-13-9-12-8-10-21-2-15-1-23	Problems and risks of daily and social activities	78.680	4.357	1.089	78.680	37.262	9.316	78.680	4.357	1.089

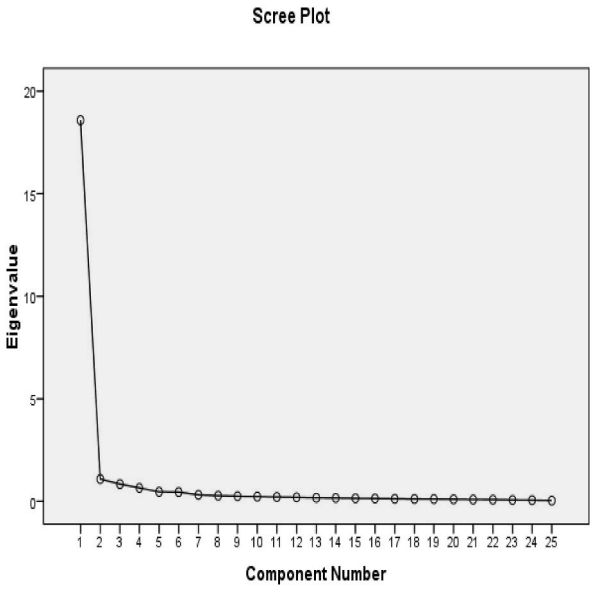


Fig. 1. Scree Plot shows the number of favorable factors in the Geriatric Locomotive Function Scale-25 questionnaire. Twenty-five questions of the questionnaire consisted of two factors. The number of extracted factors was 25 (i.e., equal to the 25 items of the tool).

questionnaire can be employed as a practical guide for the diagnosis and monitoring of locomotive syndrome in the elderly hospitalized in special care units. For better interpretation, it is suggested to stratify scores above 16 to 100 to better manage patients and plan therapeutic interventions.

Author contribution statement

Hamid Taghinejad, Elham Mohammadyari, Hamed Tavan: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Performed the experiments; Analyzed and interpreted the data; wrote the paper.

Anis Mohammadyari: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

We thank the Patients participated in the study. We also thank the Deputy of Research and Technology of Ilam University of Medical Sciences for financial support.

References

[1] M. Akahane, et al., The impact of musculoskeletal diseases on the presence of locomotive syndrome, Modern, 2018, Rheumatology 29 (1) (2018) 151–156.
[2] M. Saleh, et al., Old-Old elderly problems which can be effective in choosing their own bed, J. Geriat. Nurs. 4 (2) (2018) 20–34.
[3] N. Sadeghimahalli, et al., Locomotive syndrome in the elderly and its risk factors, Salmand. Iran, J. Age. 13 (2019) 604–613.
[4] S. Inanaga, et al., Relationship between the 25-question geriatric locomotive function scale and physical function in the elderly people, J. Bone Miner. Metabol. 8 (2023), https://doi.org/10.1007/s00774-023-01427-w.
[5] T. Kobayashi, et al., The association of comorbidities with the 25-question geriatric locomotive function scale and the diagnosis of locomotive syndrome, J. Orthop. Sci. 28 (2) (2023) 453–459.
[6] Y. Tanabe, et al., The development of the short-form of "25-question geriatric locomotive function scale, J. Adv. Med. Med. Res. 25 (10) (2023) 1–13.
[7] A. Kimura, et al., The 25-question Geriatric Locomotive Function Scale predicts the risk of recurrent falls in postoperative patients with cervical myelopathy, J. Orthop. Sci. 23 (1) (2018) 185–189.
[8] https://www.who.int/news-room/fact-sheets/detail/ageing-and-health, 2023.

[9] A. Dorahaki, R. Noubahkt, Socio-economic status of Iranian ageing women based on official statistics and policy requirements based on futuristic demographic scenarios, Payesh 19 (6) (2020) 621–632.
[10] https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS?end=2021&start=1960&view=chart, 2023.
[11] H. Tavan, et al., Factor analysis of spiritual health on the islam viewpoint, Iran, J. Public Health 11 (44) (2015) 1572–1573.
[12] H. Tavan, et al., Development and validation of a questionnaire to measure Iranian nurses' knowledge, attitude and practice regarding disaster preparedness, J. Clin. Diagn. Res. 10 (8) (2016) 6–9.
[13] M. Shohani, H. Tavan, The validity and reliability of the constructs of pain management-measuring tool for incurable patients, Iran. Red Crescent Med. J. 20 (9) (2018), e62353.