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DETERMINING THE SCIENTIFIC VALIDITY OF A FALLS RISK ASSESSMENT BATTERY FOR OLDER PEOPLE

Determinação da validade científica de uma bateria de avaliação do risco de quedas em pessoas idosas

Determinación de la validez científica de una batería de evaluación del riesgo de caídas en personas mayores

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RESUMO

Objetivo: desenvolver e validar a Bateria de Avaliação do Risco de Quedas para Idosos (BARQ), por meio da validade de conteúdo e aparência, além de estabelecer uma equação preditora dos índices específicos. **Metodologia:** estudo descritivo, transversal e exploratório, com abordagem metodológica e técnica Delphi. A versão preliminar da BARQ incluiu Histórico de

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Quedas (HQ), Medicamentos (UM), Segurança Doméstica (SD), Equilíbrio (Eq), Mobilidade (Mo) e Acuidade Visual (AC). Um quadro de peritos avaliou a validade. Utilizou-se o SPSS 22.0 com análise descritiva e Alfa de Cronbach. **Resultados:** dos 37 convidados, 17 participaram (61,5% doutores). Foram necessárias cinco rodadas Delphi para alcançar 100% de concordância (☐ ≥0,8). O índice Alfa destacou HQ (0,97), Mo (0,96) e IGRQ (0,92). **Conclusão:** a BARQ mostrou-se válida e confiável para avaliar o risco de quedas em idosos, apresentando alta consistência interna e consolidando-se como instrumento aplicável na prática clínica e em pesquisas.

DESCRITORES: Acidentes por quedas; Análise da marcha; Fatores de risco; Validade social na pesquisa.

ABSTRACT

Objective: to develop and validate the Fall Risk Assessment Battery for Older Adults (BARQ), ensuring content and face validity, and to establish a predictive equation for specific indices. **Methodology:** descriptive, cross-sectional, and exploratory study, using a methodological approach and Delphi technique. The preliminary BARQ version included Fall History (HQ), Medication Use (UM), Home Safety (SD), Balance (Eq), Mobility (Mo), and Visual Acuity (AC). A panel of experts assessed the validity. SPSS 22.0 was used for descriptive analysis and Cronbach's Alpha. **Results:** of 37 invited professionals, 17 responded (61.5% PhDs). Five Delphi rounds were required to reach 100% agreement (☐ ≥0.8). Cronbach's Alpha highlighted HQ (0.97), Mo (0.96), and General Fall Risk Index (IGRQ) (0.92). **Conclusion:** BARQ proved to be a valid and reliable tool for assessing fall risk in older adults, with excellent internal consistency and strong potential for application in clinical practice and research.

DESCRIPTORS: Fall accidents; Gait analysis; Risk factors; Social validity in research.

RESUMEN

Objetivo: Desarrollar y validar la Batería de Evaluación del Riesgo de Caídas en Personas Mayores (BARQ), asegurando la validez de contenido y apariencia, y establecer una ecuación predictiva para los índices específicos. **Metodología:** Estudio descriptivo, transversal y exploratorio, con enfoque metodológico y técnica Delphi. La versión preliminar de la BARQ incluyó Historia de Caídas (HQ), Uso de Medicamentos (UM), Seguridad en el Hogar (SD), Equilibrio (Eq), Movilidad (Mo) y Agudeza Visual (AC). Un panel de expertos evaluó la validez. Se utilizó el SPSS 22.0 con análisis descriptivo e índice Alfa de Cronbach. **Resultados:** De 37 profesionales invitados, 17 participaron (61,5% doctores). Se necesitaron cinco rondas Delphi para alcanzar el 100% de concordancia (☐ ≥0,8). El Alfa de Cronbach destacó HQ (0,97), Mo (0,96) e IGRQ (0,92). **Conclusión:** La BARQ se mostró válida y confiable para evaluar el riesgo de caídas en mayores, con alta consistencia interna y aplicabilidad clínica y científica.

DESCRIPTORES: Accidentes por caídas; Análisis de la marcha; Factores de riesgo; Validez social en la investigación.

INTRODUCTION

Falls in the elderly are one of the main concerns of geriatricians and gerontologists because of the consequences they can have.[1] Among the main complications are: fractures, immobilization, soft tissue injuries, contusions, sprains, wounds and abrasions, muscle and neurological injuries, the onset of other diseases, pain, functional decline and physical activity, medical care, hospitalization, rehabilitation, fear of falling, abandonment of activities, sadness, changes in life/behaviours, feelings of helplessness, decline in social activity, loss of autonomy and independence, change of home/environment, family rearrangement and death. Fractures and the fear of falling again were among the most frequently cited consequences.[2]

Decreased muscle contraction speed and range of motion, loss of muscle and postural strength, as well as visual and auditory changes, influence functional mobility and postural balance, aggravating the risk of falls in older people.[3] The risk of falling is even greater in elderly people who need assistance to walk and have irregularities in their gait.[4] Falls are a serious public health problem among the elderly due to their high frequency, morbidity and the high social and economic costs resulting from injuries, profoundly impacting the autonomy and functional capacity of injured individuals.[5,6]

Because of the consequences that a fall can have on this population, it is important to address the prevention of the risk of falls in the elderly, starting by assessing the risk factors.[7] A division of risk factors for falls has been established between external and internal causes, considering environmental issues

as extrinsic factors and vertigo, weakness, chronic diseases and visual acuity as intrinsic factors.[8]

The inspiration for establishing a methodology to assess the risk of falls in elderly people came from the study by Fabre et al[9], who established an algorithm to identify the variables present in published studies.

This study aimed to validate the Falls Risk Assessment Battery for the Elderly (BARQ), establishing the risk potential for each variable, as well as integrating them into a predictor equation that associates all the specific indices.

Justification and Relevance

The justification for this study lies in the growing incidence of falls in the elderly population and their serious consequences. Falls are one of the main causes of morbidity and mortality in the elderly, directly impacting on quality of life, autonomy and functional capacity. They result in prolonged hospital stays, the need for rehabilitation and, in many cases, permanent loss of mobility and independence.[10,2] In addition, falls entail high costs for the health system and families, which reinforces the urgent need for effective prevention measures.

In this context, an accurate assessment of the risk factors for falls is crucial for developing appropriate preventive strategies. Identifying and understanding the intrinsic and extrinsic factors that contribute to falls is essential for implementing targeted and personalized interventions.[11] This study aims to fill this gap by offering a scientifically validated tool for assessing these risks: the Falls Risk Assessment Battery for the Elderly (BARQ).

The relevance of this study is emphasized by the use of the Delphi technique to ensure the validation of the content and accuracy of the BARQ. This method ensures that the tool is comprehensive and appropriate, reflecting the clinical and environmental reality of older people. Furthermore, the inclusion of variables such as History of Falls and Injuries, Medication Use, Home Safety, Balance, Mobility and Visual Acuity provides a holistic and detailed assessment of fall risks, facilitating more effective and personalized interventions.[8]

In short, BARQ represents a significant advance in the field of geriatrics and gerontology, as it enhances fall prevention through rigorous, multidimensional assessment. Its practical application could significantly reduce the incidence of falls, minimizing their consequences and promoting a better quality of life for the elderly. The scientific and social relevance of this study lies in its ability to positively influence public health, offering a robust tool for health professionals and researchers and directing fall prevention policies.

METHODOLOGY

This study was descriptive, cross-sectional and exploratory in nature, which is designed to address studies that have little previous information on the object to be investigated, or because it is a problem with little scientific evidence.[12] Methodological research was also used, characterized by verifying scientific methods that involve the production-construction, validation and evaluation of instruments[13], using the Delphi technique as a methodological parameter to establish the scientific validity of the instrument.[14]

The preliminary stage of the study consisted of drawing up an initial version of a set of instruments to assess the components of the risk of falls in older people, based on the Comprehensive Falls Risk Screening Instrument – CFRSI.[9] This stage consisted of a bibliographic survey carried out on the following databases: Web of Science, Scopus, SciELO, EMBASE, Cochrane Library, LILACS and Pub Med, using the descriptors: Falls risk assessment, Geriatric assessment, Balance assessment, Gait analysis and Fall prevention. The results were analyzed using a brainstorm methodology[15], carried out by researchers from the Laboratory of Biosciences of Human Motricity - LABIMH, and a preliminary proposal was made for a Falls Risk Assessment Battery for the Elderly - BARQ.

It was established that the BARQ should preliminarily be made up of assessments of the following variables: History of Falls and Injuries - HQ, Use of Medicines - UM, Home Safety - SD, Balance - Eq, Mobility - Mo and Visual Acuity - AC. The CFRSI questionnaires were adapted and supplemented for the three initial variables.

The HQ consisted of nine questions, in which: the occurrence of falls in the last three years was investigated, specifying whether any had happened in the last 12 months; whether there was any difficulty walking; the presence of arthritis; reactions to medication; the purchase of medication from the same pharmacy; the need for corrective lenses and ophthalmological follow-up.

The UM questionnaire, made up of four questions, investigates: whether the individual takes any prescribed medication; the occurrence of side effects from medication; a description of this effect; and how many and which drugs are used. There was a need to ask the respondent to bring the packaging of the medicines used, in order to ensure that the answers were reliable. It was also necessary to categorize the drugs by brand name, salt used and drug effect. This classification was carried out by pharmacists and doctors.

Finally, the SD, which consisted of 12 questions, aims to assess home safety for the elderly, identifying potential risks of falls and

accidents. The questions cover aspects such as the presence of handrails on stairs, adequate lighting, grab bars in the bathroom, non-slip mats and the organization of the environment.

For the Balance, Mobility and Visual Acuity variables, it was decided to assess them using classic, well-established tests, namely the Functional Reach Test[16], the Expanded Timed Up-and-Go – ETUG[17] and the Snellen Diagram.[18]

Once the preliminary proposal had been established, a Panel of Expert Assessors (QPA) was set up to establish its content and appearance validity.[19] The QPA was formed for convenience, meeting the inclusion criteria (having a degree in the health area, with a master's or doctorate completed and working effectively in the area of geriatrics or gerontology) and exclusion criteria (failing to respond to one of the stages of the process). The Delphi method does not stipulate a minimum or maximum number for forming the QPA, but studies suggest a minimum of 6 and consider 20 experts to be sufficient; however, it is advisable to invite at least 30 experts, due to the response rate and loss throughout the survey. A total of 37 experts were invited, 17 of whom accepted the invitation and started the process, but only 12 completed it.

The study was carried out in full compliance with Law No. 14,874 of May 28, 2024 [20] and the Declaration of Helsinki[21], and all participants signed the Informed Consent Form. The project was submitted to the ethics committee of Tiradentes University and approved under opinion no. 6.847.94, dated May 24, 2024, under CAAE project no.: 26524719.4.0000.5371.

The Delphi technique was the methodological parameter chosen to establish the scientific validity of the instrument.[14] Questions were asked about: the relevance of the variables included in the battery (HQ, UM, SD, Eq, Mo and AC); the suitability of the instruments selected; the internal structure of the questionnaires; how to assess the results and the conceptual structure of the General Falls Risk Index - IGRQ. The answers were presented in the form of a Likert scale, with five options, ranging from Strongly Agree to Strongly Disagree. The answers were given values from 5 to 1.

After each round, using the information collected, adjustments were made to the battery to adapt it to the opinions of the QPA.

The final version of BARQ, after validation, can be seen at: https://abrir.link/MLdHn

The data collected was statistically processed using SPSS 22.0 for Windows (IBM Corp. Armonk, NY, USA), and descriptive analysis was used to characterize the sample. The Cronbach's index was used to check the level of consistency of the internal measurements. The standard established for acceptance was ≥0.8, using the Cronbach's Alpha index.

RESULTS

For the QPA, 37 professionals were initially invited, all with a master's degree or doctorate, characterized as follows: young adults and mature adults ($\bar{X}$ = 52.75 ± 6.29 years), 8% Nurses, 5% Pharmacists, 32% Physiotherapists, 13% Doctors, 42% Physical Education professionals, all working in geriatrics or gerontology, with extensive experience in the sector ($\bar{X}$ = 29.5 ± 6.85 years). Of the 37 invited, 17 responded to the evaluation instrument, with the following characteristics: 61.5% with a doctorate, 23.1% with a master's degree and 15.4% with a specialization.

Although the Delphi method recommends a minimum of three rounds to establish validity, in the specific case of this study five were necessary to meet the established acceptance criteria. The percentage of responses and levels of agreement reached in each round can be seen in Table 1.

Table 1 - Content and appearance validity results using the Delphi method

Rounds	% Answers	% of Concordance
First	-	-
Answers	83,3%	60,2%
Second	-	-
Answers	90%	70,5%
Third	-	-
Answers	100%	80,7%

Rounds	% Answers	% of Concordance
Fourth	-	-
Answers	100%	97,3%
Fifth	-	-
Answers	100%	100%

It can be seen that, from the third round onwards, the QPA was consolidated, with no more sample deaths.

In order to establish the level of consistency of the internal measurements for each of the BARQ variables, the Cronbach's Alpha index was used, with an established acceptance standard of ≥0.8. Table 2 shows the level of agreement achieved in the fifth round.

Table 2 - Level of internal consistency of the study variables

Variables		Concordance
History of Falls and Injuries - HQ	0,97	Excellent
Use of Medicines - UM	0,87	Very good
Domestic Security - SD	0,82	Very good
Equilibrium - Eq	0,83	Very good
Mobility - Mo	0,96	Excellent
Visual Acuity - AC	0,80	Very good
General Falls Risk Index - IGRQ	0,92	Excellent

Although the option of carrying out five rounds in an attempt to achieve 100% agreement made it possible to obtain ≥0.8, the alpha indices achieved in HQ (0.97), Mo (0.96) and IRQ (0.92) stand out.

DISCUSSION

The validation of the Falls Risk Assessment Battery for the Elderly (BARQ) carried out in this study represents a significant advance in the field of risk assessment in the elderly. Compared to pre-existing instruments, the BARQ showed high internal consistency, as indicated by Cronbach's alpha indices greater than 0.8 for all the variables assessed.

The results of this study indicate high internal consistency of the BARQ variables. For example, the variables History of Falls and Injuries (HQ), Mobility (Mo) and General Index of Risk of Falls (IGRQ) showed indices higher than 0.9, which exceeds the results of many previous studies in the area. Norman and Hirdes[22] and Lektip et al.[23] also used fall risk assessment instruments, but the internal reliability demonstrated by the BARQ is superior, which reinforces the robustness and accuracy of our instrument.

Using the Delphi technique to validate the BARQ, we obtained a high degree of agreement among the experts, reaching 100% at the end of five rounds. Previous studies, such as those by Niederberger and Spranger[24], Webbe et al.[25] and Li et al.[26] which also used the Delphi technique, reported

satisfactory levels of agreement, but the use of five rounds in our study allowed for a more robust consolidation of the evaluations - a fact that is not so common in the literature.

The findings of this study highlight the importance of BARQ in assessing the risk of falls in the elderly. Previous instruments, such as those used by Fabre et al[9], focused on isolated components of falls risk. In contrast, BARQ integrates multiple variables, providing a holistic and detailed view of risk factors. This integrated approach facilitates the implementation of more specific and personalized interventions, which can reduce the incidence of falls and, consequently, the rates of serious injuries and hospitalizations in older people.[27]

In addition to its clinical application, BARQ has significant implications for the formulation of public policies aimed at the health of older people. The instrument's reliability and validity allow health managers to develop fall prevention programs based on more robust evidence. Previous studies, such as those discussed by Dubey et al[28], suggest that the scientific validation of instruments is crucial to the effectiveness of public policies. BARQ can therefore provide essential data for prevention campaigns and training aimed at caregivers and health professionals, promoting safer and more active aging.[29]

Despite the promising results, some limitations must be acknowledged. The composition of the expert evaluators was limited to professionals who agreed to take part in the study, which may have introduced a selection bias. Comparisons with the study by Balas et al.[30] indicate that the inclusion of a larger and more diverse sample could further strengthen the validity of the instrument. Future studies should consider expanding the number of Delphi rounds and including participants from different cultural and demographic backgrounds to verify the generalizable applicability of BARQ.

CONCLUSION

The validation of the Falls Risk Assessment Battery for the Elderly (BARQ) demonstrated the effectiveness and reliability of the instrument, with high Cronbach's alpha indices for all the variables assessed, indicating robust internal consistency. Specifically, critical variables, such as History of Falls and Injuries (HQ), Mobility (Mo) and General Falls Risk Index (IGRQ), showed indices above 0.90. It is worth noting that, after five rounds of the Delphi method, the percentage of agreement among the experts was 100%, which confirms the scientific validity of the instrument.

The importance of BARQ for the health of the elderly is significant. Given that falls are one of the main causes of morbidity and mortality among the elderly, a validated instrument allows for a detailed and accurate assessment of risk factors. This makes it possible to implement more effective, personalized interventions aimed at preventing falls, improving the quality of life and safety of the elderly.

In addition, BARQ plays a crucial role in the formulation of public policies. By providing a reliable tool for assessing the risk of falls, health authorities and policymakers can develop more effective and evidence-based prevention programs. This can result in public health policies that not only prevent falls, but also promote healthier and more active ageing.

In summary, BARQ is an essential tool for health professionals and policymakers, as it provides a structured and scientific approach to the assessment and prevention of falls in older people. Its validation and implementation can help to significantly reduce the incidence of falls, promoting the health and well-being of the elderly population.

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