Original Article

Development and Validation of a Scale to Measure Home Safety

Stergiani Pitta, PhD (c)
Department of Speech Therapy, University of Patras, Patras, Greece

Petros Galanis, PhD
Assistant Professor, Clinical Epidemiology Laboratory, Faculty of Nursing, National and Kapodistrian University of Athens, Athens, Greece

Nikos Stefanopoulos, PhD
Associate Professor, Department of Nursing, University of Patras, Patras, Greece

Maria Zafiropoulou
NGO "Co2gether", Patras, Greece

Michael Igoumenidis, PhD
Associate Professor, Department of Nursing, University of Patras, Patras, Greece

Correspondence: Petros Galanis, Assistant Professor, Clinical Epidemiology Laboratory, Faculty of Nursing, National and Kapodistrian University of Athens, 123 Papadiamantopoulou street, GR-11527, Athens, Greece, e-mail: pegalan@nurs.uoa.gr

Abstract
Background: Home safety involves identifying existing or potential dangers within and around the residence that can cause bodily harm, injury, or death. Household incidents significantly contribute to injuries and deaths worldwide, particularly among young and elderly populations. Major causes of domestic accidents include inadequate supervision, poor safety education, and lack of awareness about potential household hazards.
Objective: The study aims to develop and validate a tool for assessing potential dangers in the homes of elderly individuals in Greece.
Methodology: The final scale includes ten components. Participants answered questions about home safety with responses categorized as "no" or "yes." Scores range from 0 to 10, with higher scores indicating greater home safety. The study involved 112 individuals from across Greece. Data were collected anonymously, without personal identifiers, and analyzed using IBM SPSS 21.0.
Results: The participants had an average age of 56.9 years. Most participants were women, accounting for 69.7% of the total, and 66.4% of them had children. 48.1% of the individuals were cohabiting with their offspring. 37.7% of individuals were residing alone, while 62.3% were cohabiting with at least one other individual. 53.3% of the population were living outside of Patras. 37.7% of the individuals were in a state of matrimony, while 62.3% were not married, divorced, or widowed. 84.5% of the kitchens were deemed safe. Out of all the cases, the bathroom was considered safe in 46.7% of them. The participants' mean self-assessed home safety ratings were higher when the researchers classified the home as safe, including all six safety characteristics.
Conclusions: The questionnaire can be utilized by educational institutions to facilitate training programs, while researchers can employ it to gather data on home safety among various demographic groups. This tool offers a holistic approach to managing dangers and fostering safe living circumstances at home.

Key Words: home safety, home environment, vulnerable groups.

Introduction

The study emphasizes the significance of domestic accidents as challenges to public health and underscores the importance of home safety for the health and well-being of individuals in their living environment (Eriksen et al., 2015). The term "home safety" refers to the awareness of existing or potential hazards both inside and outside the home that could lead to physical harm, injury, or even death for those residing there. According to

the World Health Organization (WHO) research, accidents in the home environment constitute a significant cause of injuries and fatalities worldwide, especially among children and the elderly (Mortazavi et al., 2018).

Several studies, such as the one conducted by Cox et al. (2018), highlight the frequency and severity of accidents, emphasizing the need for further research and education for home accident prevention. Kendrick et al.'s (2018) study reveals that key factors associated with domestic accidents include a lack of adequate supervision, insufficient education on safety matters, and a lack of awareness regarding potential sources of risk at home. Furthermore, risks related to falls and the need for home adaptations have been explored in studies like Clemson et al. (2012). Lastly, Moncada et al.'s (2017) study assessed knowledge and safety behaviors at home in a diverse adult population.

To date, several questionnaires have been developed to assess home safety, covering various aspects influencing safety at home. One of the most well-known questionnaires is the "Home Safety Self-Assessment Tool" (HSAT), widely used for education and self-assessment of home safety. Another questionnaire, the "Home Fall Hazards Survey" (HFHS), focuses on risk factors related to potential fall hazards at home, particularly for the elderly. Similarly, the Centers for Disease Control and Prevention (CDC) in the United States provides various questionnaires and tools for home safety, including the Home Safety Checklist. (Kruisbrink et al., 2022)

Therefore, the study aims to develop and validate a scale for assessing home risks among elderly in Greece.

Methods

Development of the questionnaire: Firstly, a scoping literature review was conducted regarding the causes of household hazards, such as falls, with a focus on demographic groups susceptible to these hazards (Tricco et al., 2017; Hopewell et al., 2018; Cameron et al., 2018). The research studies stemming from the literature review were categorized based on the population groups constituting the respective study populations, highlighting four main groups: children, adults, the elderly, and the general population. Concerning adults, (Ang et al., 2020) study examines practices and perceptions regarding home safety, while Moncada et al.'s (2017) research focuses on knowledge and behaviors within a diverse adult population. For the elderly, the works of García-Hermoso et al. (2020) and Keglovits et al. (2020) respectively explore concerns and preparedness for home safety, along with the long-term impact of home education on the safety practices of adults. Lastly, Gutman et al.'s (2018) study provides a qualitative analysis of perceptions and barriers to implementing safety measures at home. Each of these studies offers valuable insights for potential interventions and educational programs in the field of home safety, considering various age groups and their specific needs.

After all, the final scale includes ten items as shown in Table 2. These items cover home safety according to participants and answers are in “no/yes” options. The responses related to home security were aggregated to provide a security score ranging from 0 to 10, where higher scores indicate a better level of self-perceived home security among the participants. Thus, score on scale ranges from 0 to 10. Higher values are indicative of higher levels of home safety.

Study design: The final study included 112 adults from the general population of Greece. Questionnaires were distributed to participants' homes in printed form, and data were collected from May 25 to July 14, 2023. Therefore, a convenience sample was obtained. Participants were informed about the purpose and methodology of the study and provided their consent to participate. Data were collected anonymously, and no personal data were gathered. Institutional approval was obtained from the Department of Nursing at the University of Patras before conducting the study.

Validation study: A pilot study was conducted with 20 participants, including individuals from various age groups, and living arrangements, to test the face validity. Specifically, participants were asked to respond to the 10 questions in the scale and provided feedback on potential errors, omissions, and ambiguities. Minimal verbal corrections were made based on their

comments, resulting in the final version of the questionnaire. In this context, face validity of the scale was excellent.

To check the criterion validity of the scale, study researchers recorded six home safety parameters: Protective barriers, Entryway control, Kitchen safety measures, Heating system safety, Bathroom safety measures, Overall security measures (such as mercury thermometer, candles, candelabra, etc.). The researchers calculated a safety score ranging from 0 to 6 based on the participants' responses regarding home safety. A higher number indicates a higher level of safety in their homes. Then, we found the correlation between our scale and home safety score. A positive correlation denotes high criterion validity of our scale. Furthermore, we examined differences among our scale score and their safety factors that we mention above. Statistically significant relationships were indicative of criterion validity of our scale.

Furthermore, we examined the known-groups validity of our scale. In that case, we hypothesized that our scale score would be different according to: Construction year, Residential accommodation within a community, The overall area of the house, Number of rooms, not including bathrooms, Residing with offspring, Rate of disability and individuals' subjective assessment of their own health. Statistically significant relationships were indicative of known-groups validity of our scale.

Statistical analysis: Categorical variables are presented as absolute and relative frequencies, while continuous variables are presented as mean and standard deviation. The Kolmogorov-Smirnov test was used to assess the normal distribution of quantitative variables. To explore the relationship between a continuous variable and a dichotomous variable, the t-test was employed. The Pearson correlation coefficient was used to investigate the relationship between two continuous variables. The Spearman correlation coefficient was utilized to examine the relationship between a continuous variable and an ordinal variable. The two-tailed level of statistical significance was set at 0.05. Data analysis was performed using IBM SPSS 21.0 (Statistical Package for Social Sciences).

Results

The study population included 122 participants. The demographic characteristics of the participants are presented in Table 1. The average age of the participants was 56.9 years. Most participants were females (69.7%) with children (66.4%). 48.1% were living with their children. 37.7% were living alone, and 62.3% were living with at least one other person. 53.3% were residing outside Patras. 37.7% were married, and 62.3% were unmarried/divorced/widowed.

Table 1. Demographic Characteristics of Participants.

Characteristics	**N**	**%**	
Gender			
Men	37	30.3	
Women	85	69.7	
Age (Mean ± SD)	56.9	12.4	
Marital Status		N	%
Married		46	37.7
Unmarried		29	23.8
Divorced		37	30.3
Widowed		10	8.2
Children			

Characteristics	N	%
No	41	33.6
Yes	81	66.4
Living with Children		
No	42	51.9
Yes	39	48.1
Total Household Members		
1	46	37.7
2	36	29.5
3	10	16.4
4	12	9.8
>4	8	6.5
Permanent Residence		
Patras	57	46.7
Outside Patras	65	53.3

Note: Mean age, SD = Standard Deviation

Table 2 displays the level of safety in the participants' residence as determined by the researchers. Guardrails were present in 73.8% of the homes. Difficult access was reported in 27% of the dwellings. Out of all the residences surveyed, the kitchen was considered safe in 84.5% of them, while the heating was considered safe in 70.2% of them. Out of all the homes surveyed, the bathroom was deemed safe in 46.7% of them, however the surrounding space was rated safe in 60.7% of the homes.

Table 2. The researchers' assessment on the safety of the participants' residence.

Characteristics	N	%
Protective railings		
No	32	26.2
Yes	90	73.8
Entrance access		
Easy	89	73
Difficult	33	27
Kitchen Safety		
No	18	15.5
Yes	98	84.5
Heating Safety		
No	14	29.8
Yes	33	70.2

Bathroom Safety		
No	65	53.3
Yes	57	46.7
Environmental security		
No	48	39.3
Yes	74	60.7

The participants' perception of residential security is displayed in Table 3. Most participants (71.3%) reported that there are sufficient stable objects to hold onto when transitioning between rooms, in case they experience a lack of balance.

Furthermore, the house lacks any obstructions such as wires or furniture that impede movement between rooms (78.7%). Adequate illumination is also present throughout the house during movement (70.5%). Additionally, it is common for individuals to traverse the house either barefoot or with slippers (59%). In addition, they said that they do not experience any issues with slipping or sitting on and getting off the toilet (73%), there are no stairs or steps in their home (52.5%), and they do not have to stand on tiptoe to reach items in the kitchen or closet (74.6%).

Ultimately, they reported that there are no uneven surfaces, damaged pavements, slick steps, or other obstacles that cause them to stumble or fall (71.3%) when they exit the house. Furthermore, if they were to fall, get an injury, and be unable to rise, they expressed confidence in receiving prompt assistance (86.1%).

Table 3. The participants' assessment on the safety of the residence.

Characteristics	N	%
Within the premises, there are obstructions such as wires, furniture, or other objects impeding my movement between rooms.		
No	96	78.7
Yes	26	21.3
As I transition between rooms, there are numerous sturdy objects available for me to hold onto in case I experience a lack of stability.		
No	35	28.7
Yes	87	71.3
The residence is well-illuminated, even during nighttime visits to the toilet.		
No	36	29.5
Yes	86	70.5
Typically, I wear shoes when I am at home, rather than going barefoot or wearing slippers.		
No	72	59
Yes	50	41
I face difficulties in navigating onto and off the toilet alone, without the use of any aids.		
No	93	76.2
Yes	29	23.8
I experience difficulties with mobility when entering or exiting the bathtub or shower, without the use of any assistive devices.		
No	89	73

Yes	33	27
The house contains a set of stairs or steps.		
No	64	52.5
Yes	58	47.5
I elevate myself on my toes to access items in the kitchen or my closet.		
No	91	74.6
Yes	31	25.4
Upon exiting my residence, I encounter several hazards such as uneven terrain, damaged pavements, slick steps, or other obstacles that predispose me to tripping or stumbling.		
No	87	71.3
Yes	35	28.7
In the event of a fall, impact, and subsequent inability to rise, I would promptly seek assistance.		
No	17	13.9
Yes	105	86.1

Thus, the participants' subjective evaluation of the safety of their home aligns closely with the objective evaluation made by the researchers. This fact is further supported by the statistically substantial correlation ($r = 0.48$, p-value < 0.001) between the safety score of the participants' domicile as assessed by themselves and the safety score as assessed by the researchers.

Next, we investigated the correlation between participants' self-reported scores on home safety and each specific safety element graded by the researchers. The findings are displayed in Table 4. Participants' average self-rated home safety ratings were higher when the researchers determined the home to be safe, across all six safety parameters. Indeed, there were statistically significant disparities observed in the three safety criteria. This discovery demonstrates the reliability of the self-evaluation scale for home security.

Specifically, the participants' average self-rated home safety score was higher when the researchers considered entrance to be effortless ($p < 0.001$). Furthermore, the average self-rated home safety score of the participants was higher when the researchers determined the kitchen to be safe ($p = 0.001$). The participants' average safety score for their homes was much higher when the researchers deemed the heating system to be safe ($p < 0.001$).

Table 4. Correlation between participants' subjective assessment of house safety and each specific safety element assessed by researchers.

Security features	Average Safety Rating	Standard deviation	p-value[α]
Protective railings			0.4
No	6.7	1.6	
Yes	7.1	2.1	
Entrance access			<0.001
Easy	7.6	1.6	
Difficult	5.3	1.7	
Kitchen Safty			0.005
No	5.9	2.2	
Yes	7.3	1.7	

Heating safty			<0.001
No	5.2	2.1	
Yes	7.8	1.8	
Bathroom Safety			0.8
No	6.9	1.8	
Yes	6.9	2.1	
Environmental security			0.1
No	6.7	21	
Yes	7.3	1.7	

[a] T-test

Table 5 presents the correlations between the different characteristics and the safety score of the participants' residence, as determined by the researchers. Four statistically significant associations were identified, suggesting the scale's validity. Specifically, the researchers determined that houses constructed after 1978 (p<0.001), houses where parents cohabitated with their children (p=0.04), houses with a higher occupancy rate (p=0.02), and dwellings occupied by individuals with a lower disability percentage (p=0.04) were deemed safer.

Table 5. Correlations between our measurement scale and several factors

Characteristics	Average Safety Rating	Standard deviation	p-value[a]
Year of manufacture			<0.001[a]
Before 1978	6.2	2.0	
After 1978	7.6	1.6	
Residence within a settlement			0.6[a]
No	6.7	1.7	
Yes	7.0	2.0	
Total area (m^2)[a]		0.1[b]	0.3[b]
Total number of rooms excluding bathroom		0.01[c]	0.9[c]
Living with children			0.04
No	6.1	2.0	
Yes	7.1	2.3	
Disability rate		-0.2[c]	0.04[c]
Self-esteem of health		0.1[c]	0.3[c]

[a] T-test [b] Pearson correlation coefficient (PCC) [c] Spearman correlation coefficient (SCC)

Discussion

We developed a scale to measure home safety among elderly in Greece. Moreover, we examined the validity of the scale.

Various questionnaires have been developed to measure household risks (Blanchet et al.2018; Kim et al., 2018; Polivka et al., 2015). Each questionnaire has its advantages and disadvantages. These questionnaires have different structures, questions, and factors to achieve the goals set by their creators. Additionally, each questionnaire has been created for a specific population group. Therefore, it is useful and necessary to develop new questionnaires to better analyze specific aspects of home safety.

Urbanization has caused the social and kinship structure to break down, leading to feelings of loneliness and isolation among the elderly (Hajek et al.,2017). Most of the participants resided either alone (37.7%) or with their partner (29.5%) in areas outside the metropolitan environment (53.3%). Having a younger family member or professional caregiver provide care and supervision can help prevent falls and catastrophic injuries. (Petersen et al., 2020)

Furthermore, of all the falls that occur within a household, those that happen in the bathroom are the most likely to cause an injury. A total of 53.3% of respondents indicated that the bathroom environment is considered unsafe. These findings highlight the necessity of enhancing safety measures in the restroom. This may involve: 1) seeking help from someone else to bathe; 2) using safer techniques in the bathroom (such as wearing shoes with non-slip soles, storing toiletries on easily accessible shelves, and using assistive devices safely), and 3) utilizing or installing safety equipment (such as non-skid mats for the tub or shower, grab bars inside and outside the bathing area, and raised toilet seats) (Zhao et al.,2019).

Moreover, a significant proportion of individuals held a fallacious belief on the level of safety in their residences. After receiving the researchers' ideas, many individuals perceived their homes as being more secure. This observation indicates the necessity of providing ongoing information to elderly individuals so that they can modify their surroundings in a manner that minimizes the likelihood of falls.

Finaly through component analysis, we have determined that homes constructed prior to 1978 are less secure compared to those built after 1978. The architecture and building materials used in homes built prior to 1978 have a substantial impact on their safety. During that era, there were notable disparities between the building regulations of that time and the regulations that are in place now. Several of these residences may possess structural deficiencies resulting from the absence of contemporary safety standards (Smith et al.,2017).

The self-administered home safety questionnaire we developed offers several advantages. Firstly, it enables individuals to self-assess their home environment, providing an objective overview of potential issues. It serves as a tool for raising awareness, highlighting safety aspects that might be overlooked. Additionally, it provides an opportunity for action, allowing individuals to identify areas needing improvement and take measures to enhance safety (Dellinger,2017). It serves as a starting point for discussions with healthcare professionals or family members. Furthermore, it allows for progress tracking and monitoring changes in the home environment over time. This tool can be utilized by healthcare professionals, social services, elderly care centers, educational institutions, and researchers for various purposes, fostering awareness and personal responsibility for home safety. Healthcare professionals, such as doctors and nurses, can leverage the questionnaire to assess the risk of falls and propose preventive measures. Social services can offer support through the questionnaire, while elderly care centers can improve the safety of the living environment. Additionally, educational institutions can use the questionnaire for training programs, and researchers can collect data on home safety across diverse population groups. In this way, the questionnaire provides a comprehensive tool for addressing risks and promoting safe living conditions at home.

Limitations: The results of the study are not generalizable as they apply to a specific population and a specific demographic district with distinct characteristics. Additionally,

although the research tool used proved to be reliable, it has not been validated for accuracy. Furthermore, in some instances, due to small sample sizes, non-parametric tests with lower statistical power were conducted. Finally, a limitation of the research is the use of convenience sampling.

Conclusions: In conclusion, we have developed a self-administered questionnaire with reliability considerations for measuring home safety. We have established a self-report questionnaire model for participants, consisting of 10 questions. The assessment of home safety is crucial for implementing appropriate measures and promoting health while preventing accidents. Therefore, further studies are recommended to expand knowledge in the field of home safety and derive more valid results.

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