BMC Nursing

RESEARCH

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Development and validation of a comfort-measuring scale for elderly individuals with chronic conditions

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Abstract

Background Ageing is associated with chronic diseases and successive losses, which affect the comfort experienced by the elderly. Hence, in that population, comfort must be viewed as a need, and health care professionals (particularly nurses) should promote it through their interventions. This work aimed at developing a scale to assess comfort in elderly individuals with chronic conditions and determining the aforesaid scale's psychometric characteristics (validity and reliability), while ascertaining the comfort levels experienced by the participants.

Methods Our sample comprised 454 chronically ill elderly individuals, either hospitalized, or in residential care/at home. As regards descriptive statistics, we calculated various summary measures. Validity was appraised via exploratory factor analysis, considering the main components. We performed varimax rotation and factor extraction (in which factors with eigenvalues > 1 were extracted). Reliability was established by calculating internal consistency, using Cronbach's alpha. For each scale item, we examined the corrected item-test correlation. Additionally, we calculated skewness and kurtosis, also carrying out a confirmatory factor analysis.

Results The exploratory factor analysis produced a scale with 38 items and five factors, which fitted the data and explained a variance of 61.355%. The values of the Kaiser-Meyer-Olkin test and the Bartlett's test (sphericity) were 0.943 and 12055.962, respectively (both with $p < 0.001$). Our model was substantiated by the confirmatory factor analysis ($\chi^2 = 2884.242$; df = 660; RMSEA = 0.086; CFI = 0.811; TLI = 0.798; SRMR = 0.066) and the Cronbach's alpha coefficient was 0.959. The summary measures showed that, overall, the participants experienced good comfort levels (Mean = 3.64; SD = ±0.676), revealing higher comfort levels in the "Spirituality and meaning of life" dimension (Mean = 3.79; SD = ±0.742) and lower comfort levels in the "Normality of life" dimension (Mean = 3.39; SD = ±0.922).

Conclusion The scale demonstrated suitable psychometric properties, ensuring its validity and reliability in assessing comfort in elderly individuals with chronic conditions. Its five-factor structure enables a comprehensive evaluation, highlighting key comfort dimensions. These findings support targeted interventions, aiding healthcare professionals in improving care and informing evidence-based practices and health policies to enhance well-being.

Implications for nursing and health policy By measuring comfort levels in chronically ill elderly individuals, it is possible to plan/improve the comforting care provided by the involved professionals (namely nurses).

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Clinical trial number Not applicable.

Keywords Comfort, Elderly, Chronic disease, Scale, Validation study

Introduction

Ageing and disease chronicity have an enormous impact on the elderly, generating multiple discomforts. A condition is classified as chronic when it is long-lasting (usually more than three months of duration), its progression is slow and it requires continuous management. Common examples include most cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes [1, 2]. According to Peplau, such conditions frequently persist throughout life, demanding a comprehensive approach, which involves medical treatment and emotional/social support [3]. The latter is provided by different health care professionals (particularly nurses), influencing the individual's reactions to the ageing process and to chronic illness [4].

By establishing a professional-individual relationship, nurses can implement comfort-promoting measures, avoid the onset of discomfort and alleviate/reverse existing discomforts. However, since comfort is a dynamic state, often partially achieved and only for a limited period, the chosen interventions must be constantly reassessed [5]. In consequence, there is a need to measure comfort and to define structured interventions that consider the individual's uniqueness, with the aim of promoting an increased and improved comfort [5].

Katherine Kolcaba viewed comfort as an experience of finding oneself strengthened, by having one's needs of relief, tranquility, and transcendence met in four contexts: physical, psychospiritual, sociocultural and environmental [6]. This concept goes far beyond the absence of pain/other physical discomforts [6]. Comforting interventions are intentional acts that seek to fulfill specific comfort needs. Such interventions can be physiological, psychological, social, cultural, financial, spiritual, environmental, or physical [7, 8].

Focusing on the comfort of hospitalized elderly individuals with chronic conditions, Sousa grouped the reported comfort needs into four domains: (i) Changes in the health/disease process; (ii) Attitudes towards oneself and life; (iii) Service structure/functioning; and (iv) Family/significant people [5]. This study demonstrated that the process of comforting care provision is based on a multisystem and multifactor interaction between those involved, being influenced by the context in which care is provided. Accordingly, the process' outcome is affected by the manners/means used for comforting, as well as by each individual's conceptions of comfort/non-comfort. As a result, the intervention's effecting goes beyond the act itself, being a co-created effort "that addresses the Other's singularity and needs, while showing respect […]"[1] [5, p.56].

Adopting an ontological point of view, and integrating the available scientific evidence, Veludo defines comfort taking into consideration the complexity of human experience. Therefore, comfort is portrayed as a state that should be understood from the perspective of those who live it [9]. In a scoping review, which mapped 109 articles, Veludo concluded that "comfort is a sensation arising from any experience an individual may live, the product of any physical, psychospiritual, sociocultural, or environmental, interaction (antecedents) [9]. It is characterized by a set of attributes, which, when present, give it meaning: Safety; Control; Self-realization; Belonging; Peace and Fullness; Relaxation; and Normality of Life. And the feeling of comfort strengthens the individuals, increases their ability to deal with life's adversities (Resilience/Coping), favors a serene death, and improves the institutional results of healthcare organizations (consequences)"[2] [9, p.163].

Caring for the elderly with chronic illness requires us to consider their uniqueness in relation to their life history and past experiences (culture, religion, spirituality, relationships, among others) that influence the way they are and interact with others. Since the person is at the center of nursing, the specificity of the nursing process should require nurses to be able to reason and be competent to focus their practice on the dimensions of the person [5].

McCormack and McCance's person-centered nursing model emphasize authentic awareness over knowledge of the person's values and opinions. It reflects the ideals of humanistic nursing, where there is a moral component and nursing practice is based on therapeutic intent, which translates into relationships built on effective interpersonal relationships [10]. According to the model, nursing is an approach to practice established through the formation and promotion of therapeutic relationships based on respect for the person, the individual's right to self-determination, and mutual respect and understanding, through cultures of empowerment that promote humanistic development [10]. Person-centered care evolves from communication between the person and the professional. When effective communication is established, there is an interest in listening and the professional becomes available to understand the person's perspective [10].

[1] Freely translated from Portuguese.

[2] Freely translated from Portuguese.

Understanding the determinants of comfort for the older person with a chronic illness is fundamental to the intervention of health professionals, particularly nurses [5]. It is essential that nurses assess the level of comfort of older people with chronic illness and implement effective comfort interventions, particularly in residents of long-term care institutions for the elderly [11]. In this logic, given the subjectivity inherent in measuring comfort [5, 12, 13], this study aims to develop a scale (Global Comfort Scale - Elderly) to measure comfort in elderly people with chronic illness in long-term care institutions for the elderly.

Materials and methods

Methodological design

The present study adopted a quantitative cross-sectional approach between 2022 and 2024. It aimed at developing a scale to assess comfort in elderly individuals with chronic conditions and determining the aforesaid scale's psychometric characteristics (validity and reliability), while ascertaining the comfort levels experienced by the participants.

The formulation of the research questions followed the approach described by Hosseini et al. [14], who propose principles for the construction of research questions in evidence-based studies: (i) What is the level of comfort of older people with chronic illnesses in long-term care institutions for the elderly? (ii) What are the psychometric characteristics (internal consistency and validity) of the GCS-E for measuring the comfort of older people with chronic illnesses in long-term care institutions for the elderly? (iii) Does the comfort of older people with chronic illnesses in long-term care institutions for the elderly assessed using the GCS-E differ according to their age and gender?

We defined the following specific objectives for this study: (i) To assess the level of comfort of elderly people with chronic illnesses in long-term care institutions for the elderly; (ii) To determine the psychometric characteristics (internal consistency and validity) of the GCS-E in measuring the level of comfort of elderly people with chronic illnesses in long-term care institutions for the elderly; (iii) To determine the level of comfort of elderly people with chronic illnesses in long-term care institutions for the elderly assessed by the GCS-E according to their age and gender.

To achieve these objectives, we conducted a research effort that encompassed two phases: (1) Development of a scale to assess comfort in chronically ill elderly individuals ("Global Comfort Scale – Elderly", hereinafter referred to as "GCS-E"), followed by face and content validation of the initial scale's items; and (2) Evaluation of the scale's psychometric characteristics.

Population under study and sampling procedures

To validate the GCS-E, we used a sample consisting of elderly individuals (aged 65 or over), chronically ill (diseases lasting more than three months and with a slow progression, requiring continuous management), able to speak/understand Portuguese, and with sufficient cognitive capacity to perform self-assessment (Mini Mental State Examination: > 15 points for illiterate patients; > 22 points for patients with up to 11 years of schooling; and >27 points for patients with more than 11 years of schooling), who freely consented to participate in the study.

To calculate the sample's size, we applied a proportion recommended by several authors, thus considering 5–10 individuals for each item included in the scale [15, 16].

Data collection

Relevant data was gathered by means of a questionnaire presented in Portuguese (self or hetero filled, depending on the participant's physical capacity), between June 2022 and June 2024, in different contexts (the medical ward of a hospital located in the Lisbon area, residential care facilities, or the participants' homes). The elderly individuals who still lived at their own houses received support from residential care facilities. In order to select the participants, we used non-probability sampling, as we preferred to employ an intentional sampling technique, based on a conscious choice to include/exclude certain elements according to their characteristics.

The questionnaire addressed the following aspects: (I) sociodemographic variables (gender, age, marital status, educational/academic background, profession/occupation, and current residence/place of permanence) and clinical variables (history of chronic illness); (II) GCS-E, encompassing 55 indicators on a Likert-type scale, with answers ranging from 1 to 5 – not comfortable at all (1), slightly comfortable (2), reasonably comfortable (3), very comfortable (4), and totally comfortable (5).

The procedures used for developing and validating the GCS-E are described below.

Phase 1: Development of the GCS-E

Conceptual framework

The conceptual framework and the preliminary items were obtained through a scoping review, which aimed at defining the concept of comfort, by mapping a sample that comprised 109 works [9]. Regarding the number of preliminary items, since there is no consensus within the available literature, we followed the principle of establishing at least, three times as many components as those included in the final tool [17]. Thus, we considered 76 preliminary items, preferring not to group them according to the attributes defined by Veludo, to better evaluate the psychometric analysis' results.

Face and content validation of the preliminary items

To assess face validity in a qualitative manner, 20 elderly individuals and two experts in psychometrics were asked to appraise various features: sentence/word clarity, appropriateness for the target population in terms of difficulty, item coherence/relevance, potential for ambiguity, and necessity to remove/combine items. This process sought to determine whether the items actually measured what we intended to measure [18].

Content validity was ascertained by a panel of experts, using the Delphi technique and following the steps recommended in the available literature [17, 19]. The 76 preliminary items obtained during the conceptual framework stage were appraised by the experts, who performed two rounds of assessment. To select the panel's 12 elements, we considered, as inclusion criteria, possessing an adequate knowledge demonstrated through advanced training, and having published works on the employed method and/or the studied concept. After the initial round, the panel recommended excluding 21 items, due to the presence of other items with similar content. The experts also suggested reformulating six items, to facilitate the interpretation of the respective semantic value.

After the expert opinion (round 2), we determined the Item Content Validity Index (I-CVI), by calculating the items' clarity (Ic-CVI), pertinence (Ip-CVI), and relevance (Ir-CVI). The instrument's overall content validity (measured via the Scale Content Validity Index – S-CVI) was also established, by calculating the scale's clarity, pertinence, and relevance [20]. Both for the I-CVI and the S-CVI, we considered, as acceptability criterion, a lower limit of 0.80 [20, 21].

The content validation process produced a scale consisting of 55 items, with an I-CVI higher than 0.80. Regarding item clarity (Ic-CVI), 41 elements (74.5%) achieved an agreement level of 1.00, while 11 elements (20.0%) obtained results between 0.90 and 1.00, and three elements (5.5%) only reached values between 0.80 and 0.90. As for item pertinence (Ip-CVI), 10 elements (18.2%) achieved an agreement level of 1.00, while 23 elements (41.8%) obtained results between 0.90 and 1.00, and 22 elements (40.0%) only reached values between 0.80 and 0.90. Concerning item relevance (Ir-CVI), 23 elements (41.8%) achieved an agreement level of 1.00, while 20 elements (36.4%) obtained results between 0.90 and 1.00, and 12 elements (21.8%) only reached values between 0.80 and 0.90. Moreover, we attained the following S-CVI results: 0.97 for clarity; 0.90 for pertinence; and 0.93 for relevance. Since the calculated values are all higher than 0.80, we can infer that the instrument's content allows measuring what we intended to measure [22].

Phase 2: Evaluation of the GCS-E

During this stage, we evaluated the following aspects: construct validity, convergent validity, discriminant validity, criterion validity, and overall reliability.

Data analysis

To analyze the collected data, we used the Statistical Package for Social Sciences (SPSS), version 26.0. This software allowed us to conduct various statistical tests. Additionally, we carried out a confirmatory factor analysis, employing Jeffreys's Amazing Statistics Program (JASP), version 0.13.1.0 [23].

To depict the participants' basic attributes, we used descriptive statistics, calculating different summary measures.

Multivariate normality was ascertained by determining skewness and kurtosis, considering ≤ 3 and ≤ 7, respectively, as reference values [24].

To establish the scale's psychometric characteristics, we performed validity and fidelity tests, also evaluating the instrument's reliability. To this end, we applied the following criteria:

- Regarding each item's Pearson correlation with the whole scale, values greater than 0.20 were considered satisfactory, while other values were corrected;
- Concerning the factor analysis (which appraises the homogeneity/similarity of the instrument's items/questions), the model's suitability to the correlation matrix was ensured through the Kaiser method, together with the Kaiser-Meyer-Olkin test (>0.6) and the Bartlett's test of sphericity (<0.05). When deciding on item retention, we considered a minimum factor loading of 0.5 [23];
- With respect to Cronbach's alpha, we examined the values of all the included items, also taking into account the scale's overall results, after excluding each item individually;
- When conducting the exploratory factor analysis, we used principal axis factoring with varimax rotation [22, 24]. Factor loadings below 0.4 were suppressed, while item cross-loadings greater than 0.2 were systematically eliminated, one by one [25];
- Construct validity was assessed via confirmatory factor analysis. Although chi-square tests are widely employed to evaluate how well models fit the collected data, we decided to use other goodness of fit measures, due to the influence of sample size. Accordingly, we calculated several adjustment indices, namely: the Goodness of Fit Index (GFI); the Comparative Fit Index (CFI); the Standardized Root Mean Square Residual (SRMR); the Root Mean Square Error of Approximation (RMSEA); the Parsimony Normed Fit Index (PNFI); the Bentler-

Bonett Non-Normed Fit Index (NNFI) / Tucker Lewis Index (TLI); the Expected Cross-Validation Index (ECVI); and the Akaike Information Criterion (AIC) [26];

- An independent-sample t-test was applied, to explore the potential existence of statistically significant differences between male and female participants, as regards the GCS-E. Furthermore, the subscale-scale relationship was ascertained using Pearson correlation coefficients [27].

Ethical considerations

This study was approved by the institutional ethics committee of Universidade Católica Portuguesa (Approval No. 91/2020). We followed the ethical principles established in the Declaration of Helsinki, which ensure respect for each individual and his/her self-determination. Prior to the survey, the participants were given sufficient information about the study's purpose, the data's intended use, and the data's protection. Also, before the survey, an informed consent was obtained from all the participants, by means of a consent form.

Results

Sociodemographic and clinical characterization of the studied sample

The questionnaire developed for this study (supplementary file), was applied to 454 participants, mostly women (330; 72.7%). Regarding age, the sample's average was 80.77 ± 9.21 years old, with the youngest individual being 66 and the oldest individual being 99. Concerning marital status, most of the participants had already lost his/her spouse (204; 44.9%). In relation to the individuals' educational/academic background, 32 (7.0%) could neither read, nor write, since they had had no schooling at all. With respect to the individuals' residence/place of permanence, 220 (48.5%) were institutionalized in residential care facilities. All the participants had a history of chronic illness, with cardiovascular diseases being the most prevalent (102; 22.5%). Nevertheless, 122 individuals (26.9%) reported suffering from more than one chronic malady. Additional information on the sample's sociodemographic and clinical characteristics can be found in Table 1.

Descriptive statistics, skewness, and kurtosis, of the GCS-E

After a preliminary internal consistency evaluation, followed by a factor analysis, we decided to eliminate several items, either because the alpha value without the

Table 1 Sociodemographic and clinical characterization of the studied sample ($n = 454$) and Chi-square test results

Variables		*n* (%)	χ2
Gender	Male	124 (27.3%)	435.395; $p = 0.136$
	Female	330 (72.7%)	
Marital status	Single	34 (7.5%)	1730.562; $p = 0{,}024$
	Married	180 (39.6%)	
	De facto union	2 (0.4%)	
	Divorced/separated	34 (7.5%)	
	Widower/widow	204 (44.9%)	
Educational/academic background	No schooling (unable to read/write)	32 (7.0%)	**3030.429;** $p = 0$,**004**
	Primary education – 1st cycle (4th grade)	180 (39.7%)	
	Primary education – 2nd cycle (6th grade)	48 (10.6%)	
	Primary education – 3rd cycle (9th grade)	35 (7.7%)	
	Secondary education (12th grade)	73 (16.1%)	
	Higher education	86 (18.9%)	
Residence/place of permanence	Living at home	178 (39.2%)	867.325; $p = 0{,}072$
	Institutionalized (residential care facilities)	220 (48.5%)	
	Hospitalized	56 (12.3%)	
History of chronic illness	Cardiovascular disease	102 (22.5%)	3587.918; $p = 0{,}712$
	Metabolic disease	46 (10.1%)	
	Respiratory disease	39 (8.6%)	
	Kidney disease	20 (4.4%)	
	Cerebrovascular disease	42 (9.3%)	
	Neurological disease	40 (8.8%)	
	Liver disease	2 (0.4%)	
	Neoplastic disease	15 (3.3%)	
	Osteoarticular disease	26 (5.7%)	
	More than one chronic disease	122 (26.9%)	

item was higher than the overall alpha value (internal consistency), or because the item showed a saturation lower than 0.5 (factor analysis). Items that did not clearly relate to a single factor (i.e., with a loading difference inferior to 0.1) were also removed. Consequently, during this stage, we suppressed a total of 17 items, thus producing a final scale that contained 38 items.

Table 2 exhibits some of the final scale's summary measures, as well as the values associated with skewness and kurtosis (which reflect the items' sensitivity, thus contributing to the instrument's psychometric appraisal). The items showed mixed skewness (ranging from – 0.790 to 0.001) and mixed kurtosis (ranging from – 1.031 to 0.652). If skewness values between – 2 and + 2, and kurtosis values between – 7 and + 7, are indicative of a normal

Table 2 Descriptive statistics, skewness, and kurtosis, of the GCS-E

Items (original in Portuguese / English translation)	Mean	SD	Skewness	Kurtosis
1 – "*Sinto-me seguro*" / "I feel safe"	3.75	0.938	-0.361	-0.306
2 – "*Sinto-me informado*"/ "I feel informed"	3.48	0.987	-0.195	-0.364
3 – "*Sinto que posso obter o que preciso*" / "I feel that I can obtain what I need"	3.45	1.068	-0.272	-0.384
4 – "*Sinto-me cuidado(a) por pessoas competentes*" / I feel cared for by competent people	3.85	0.943	-0.346	-0.401
5 – "*Sinto confiança nos outros*" / "I feel trust toward other people"	3.52	1.000	-0.346	-0.222
6 – "*Sinto que a minha situação está sob controlo*" / "I feel that my situation is under control"	3.61	1.014	-0.289	-0.508
7 – "*Sinto-me capaz de decidir sobre a situação atual*" / I feel able to decide on the current situation	3.57	1.197	-0.471	-0.672
8 – "*Sinto que controlo a minha situação*" / "I feel in control of my situation"	3.44	1.135	-0.258	-0.719
9 – "*Sinto que controlo a minha vida*" / "I feel in control of my life"	3.44	1.149	-0.255	-0.687
10 – "*Sinto-me capaz de tomar decisões*" / "I feel able to make decisions"	3.79	1.118	-0.679	-0.273
11 – "*Sinto-me capaz de gerir as minhas prioridades*" / "I feel able to manage my priorities"	3.72	1.110	-0.588	-0.362
12 – "*Sinto-me bem como sou*" / "I feel good the way I am"	3.87	1.015	-0.746	0.105
13 – "*Sinto-me bem nas minhas relações pessoais*" / "I feel good in my personal relationships"	3.86	0.983	-0.522	-0.373
14 – "*Sinto-me capaz de manter/restabelecer as minhas relações pessoais*" / "I feel able to maintain/restore my personal relationships"	3.81	0.975	-0.585	-0.056
15 – "*Sinto-me livre para discutir as minhas experiências*" / "I feel free to discuss my experiences"	3.74	1.072	-0.733	0.028
16 – "*Sinto-me livre para discutir os meus sentimentos*" / "I feel free to discuss my feelings"	3.65	1.091	-0.557	-0.262
17 – "*Sinto que os que me rodeiam são afetuosos comigo*" / "I feel that those around me are affectionate toward me"	3.84	0.884	-0.600	0.393
18 – "*Sinto que os outros se preocupam comigo*" / "I feel that other people care about me"	3.82	0.978	-0.770	0.464
19 – "*Sinto-me respeitado(a)*" / "I feel respected"	3.95	0.910	-0.656	0.192
20 – "*Sinto-me tratado(a) com dignidade*" / "I feel treated with dignity"	3.93	0.938	-0.604	-0.065
21 – "*Sinto-me compreendido(a)*" / "I feel understood"	3.63	1.017	-0.414	-0.351
22 – "*Sinto gratidão*" / "I feel gratitude"	3.98	0.982	-0.907	0.652
23 – "*Sinto que, quando preciso, tenho pessoas que me ajudam*" / "I feel that, when I need it, I have people who help me"	4.07	0.895	-0.793	0.443
24 – "*Sinto-me capaz de ajudar os outros*" / "I feel able to help others"	3.71	1.165	-0.661	-0.358
25 – "*Sinto-me em paz*" / "I feel at peace"	3.93	1.000	-0.653	-0.127
26 – "*Sinto-me tranquilo(a)*" / "I feel calm"	3.80	0.999	-0.368	-0.609
27 – "*Sinto-me ligado(a) a um poder maior*" / "I feel united with a higher power"	3.59	1.297	-0.639	-0.609
28 – "*Sinto que a vida tem valido a pena*" / "I feel that life has been worth living"	3.99	0.948	-0.790	0.332
29 – "*Sinto que a vida vale a pena*" / "I feel that life is worth living"	3.92	1.049	-0.788	0.160
30 – "*Sinto-me capaz de pensar sobre a minha vida e a minha morte*" / "I feel able to think about my life and my death"	3.67	1.157	-0.636	-0.322
31 – "*Sinto-me capaz de falar sobre a minha vida e a minha morte*" / "I feel able to talk about my life and my death"	3.59	1.132	-0.412	-0.600
32 – "*Sinto-me fisicamente bem*" / "I feel well, physically"	3.07	1.073	0.001	-0.464
33 – "*Sinto-me capaz de cuidar de mim*" / "I feel able to take care of myself"	3.30	1.198	-0.172	-0.800
34 – "*Sinto-me capaz de realizar as minhas rotinas*" / "I feel able to carry out my routines"	3.41	1.201	-0.326	-0.763
35 – "*Sinto que as minhas necessidades estão satisfeitas*" / "I feel that my needs are met"	3.55	1.065	-0.386	-0.289
36 – "*Sinto-me independente*" / "I feel independent"	3.24	1.307	-0.193	-1.031
37 – "*Sinto que desempenho os meus papéis habituais (pessoal, familiar, social)*" / "I feel that I perform my usual roles (personal, family, social)"	3.49	1.146	-0.322	-0.659
38 – "*Sinto-me útil*" / "I feel useful"	3.42	1.174	-0.306	-0.711

SD: Standard Deviation

distribution [25], all the included items appear to fall within that category.

Factor analysis and internal consistency

Regarding the exploratory factor analysis, we determined the adequacy of the sample's size, using the Kaiser-Meyer-Olkin (KMO) test, and considering reference values between 0.5 and 1. We obtained a result of 0.943, with a significance inferior to 0.001. Additionally, we applied the Bartlett's test of sphericity, which establishes the quality of the existing correlations between the studied variables. The obtained result ($\chi^2 = 12055.962$; $p < 0.001$) led to the rejection of our null hypothesis. By combining these results, we were able to proceed with the exploratory factor analysis, considering the main components. We performed a varimax rotation of the scale's items, which allowed extracting five factors, as shown in Table 3. Together, the extracted factors explained 61.355% of the total variance.

Considering the items associated with each factor, as well as the respective weight, the five extracted factors were named as follows: Self-realization and belonging (F1); Normality of life (F2); Spirituality and meaning of life (F3); Control (F4); and Safety (F5). These factors characterize the comfort levels experienced by elderly individuals.

As regards the GCS-E, Table 4 exhibits various summary measures (descriptive statistics), as well as the Cronbach's alpha results (internal consistency). Furthermore, it shows the number of items included in each subscale, together with the subscale's mean and median scores. It should be noted that the mean scores are similar for all the considered factors.

Moreover, Table 5 demonstrates the existence of a moderate to strong correlation between overall comfort and its factors, as well as between the different factors being considered.

We also found that overall comfort was not influenced by the participants' gender ($t = 0.778$; $p > 0.05$), the same being true for the extracted factors, except for F5 – "Safety" ($t = 2.178$; $p < 0.05$).

This factorial model was tested by means of a confirmatory factor analysis. Afterward, the initial model was refined, in accordance with the modification indices proposed by JASP. As a result, we obtained the values exhibited in Table 6, which reveal the model's reasonable adequacy, despite some values being slightly lower/higher than those recommended [23, 27, 28].

Assessment of the participants' comfort levels

By applying the final version of the GCS-E to our sample, we discovered that elderly individuals with chronic conditions were generally comfortable, presenting an average comfort score of 3.64 (SD = 0.676). We also found that older individuals with higher levels of education felt more comfortable, with statistically significant differences ($\chi^2 = 30.429$; $p = 0.004$), as shown in Table 1.

Additionally, participants reported higher comfort levels in the "Spirituality and Meaning of Life" dimension (Mean = 3.79; SD = 0.742) and lower comfort levels in the "Normality of Life" dimension (Mean = 3.39; SD = 0.922).

Furthermore, the item that provided the most comfort was in the "Self-Realization and Belonging" dimension: *"I feel that, when I need it, I have people who help me"* (Mean = 4.07; SD = 0.895). On the other hand, the item that provided the least comfort was in the "Normality of Life" dimension: *"I feel well, physically"* (Mean = 3.07; SD = 1.90).

Discussion

Comfort is a sensation experienced at a given moment, being also a need felt throughout life (Veludo). In the elderly, due to physical and psychosocial changes, discomfort may become persistent, thus requiring appropriate interventions from health care professionals (particularly nurses) [29].

This study allowed developing a scale to assess comfort in elderly individuals with chronic conditions (the GCS-E), based on the literature review conducted by Veludo [9]. In addition, we verified the developed instrument's validity and reliability. Regarding the content's construction and validation, they followed a specific methodology, which involved a panel of experts. In accordance with the steps recommended in the available literature, the aforesaid panel used the Delphi technique to carry out the required process [19]. Afterward, we appraised the scale's psychometric characteristics, also performing an exploratory factor analysis and a confirmatory factor analysis, to determine the tool's validity and reliability.

While the initial version of the GCS-E comprised 55 items, the final version only contained 38 items. Therefore, as previously mentioned, 17 items were excluded during the validation process. This can be explained by the participants' characteristics and the contexts in question. By including in our sample elderly individuals from different settings (12.3% hospitalized, 48.5% institutionalized in residential care facilities, and 39.2% living at home), we achieved a more comprehensive portrayal of the studied population, thus considering items that were not connected with housing/social status.

The exploratory factor analysis was performed taking into consideration the main components, with a varimax rotation of the scale's items. It allowed extracting five factors, which, together, accounted for 61.355% of the total variance. The KMO test produced a result of 0.943, with a significance inferior to 0.001. These values confirmed the adequacy of the sample's size [25].

Table 3 Rotated component matrix

Item Labels (original in Portuguese / English translation)	H^2	F1	F2	F3	F4	F5
13 – "*Sinto-me bem nas minhas relações pessoais*" / "I feel good in my personal relationships"	0.681	**0.648**				
14 – "*Sinto-me capaz de manter/restabelecer as minhas relações pessoais*" / "I feel able to maintain/restore my personal relationships"	0.635	**0.626**				
15 – "*Sinto-me livre para discutir as minhas experiências*" / "I feel free to discuss my experiences"	0.588	**0.486**				
16 – "*Sinto-me livre para discutir os meus sentimentos*" / "I feel free to discuss my feelings"	0.592	**0.564**				
17 – "*Sinto que os que me rodeiam são afetuosos comigo*" / "I feel that those around me are affectionate toward me"	0.577	**0.674**				
18 – "*Sinto que os outros se preocupam comigo*" / "I feel that other people care about me"	0.693	**0.789**				
19 – "*Sinto-me respeitado(a)*" / "I feel respected"	0.715	**0.731**				
20 – "*Sinto-me tratado(a) com dignidade*" / "I feel treated with dignity"	0.733	**0.694**				
21 – "*Sinto-me compreendido(a)*" / "I feel understood"	0.665	**0.709**				
22 – "*Sinto gratidão*" / "I feel gratitude"	0.571	**0.667**				
23 – "*Sinto que, quando preciso, tenho pessoas que me ajudam*" / "I feel that, when I need it, I have people who help me"	0.527	**0.561**				
24 – "*Sinto-me capaz de ajudar os outros*" / "I feel able to help others"	0.533		**0.618**			
32 – "*Sinto-me fisicamente bem*" / "I feel well, physically"	0.606		**0.695**			
33 – "*Sinto-me capaz de cuidar de mim*" / "I feel able to take care of myself"	0.729		**0.772**			
34 – "*Sinto-me capaz de realizar as minhas rotinas*" / "I feel able to carry out my routines"	0.713		**0.795**			
35 – "*Sinto que as minhas necessidades estão satisfeitas*" / "I feel that my needs are met"	0.566		**0.573**			
36 – "*Sinto-me independente*" / "I feel independent"	0.695		**0.786**			
37 – "*Sinto que desempenho os meus papéis habituais (pessoal, familiar, social)*" / "I feel that I perform my usual roles (personal, family, social)"	0.630		**0.685**			
38 – "*Sinto-me útil*" / "I feel useful"	0.691		**0.725**			
12 – "*Sinto-me bem como sou*" / "I feel good the way I am"	0.428			**0.428**		
25 – "*Sinto-me em paz*" / "I feel at peace"	0.610			**0.575**		
26 – "*Sinto-me tranquilo(a)*" / "I feel calm"	0.600			**0.549**		
27 – "*Sinto-me ligado(a) a um poder maior*" / "I feel united with a higher power"	0.312			**0.533**		
28 – "*Sinto que a vida tem valido a pena*" / "I feel that life has been worth living"	0.545			**0.602**		
29 – "*Sinto que a vida vale a pena*" / "I feel that life is worth living"	0.559			**0.581**		
30 – "*Sinto-me capaz de pensar sobre a minha vida e a minha morte*" / "I feel able to think about my life and my death"	0.591			**0.725**		
31 – "*Sinto-me capaz de falar sobre a minha vida e a minha morte*" / "I feel able to talk about my life and my death"	0.547			**0.675**		
7 – "*Sinto-me capaz de decidir sobre a situação atual*" / "I feel able to decide on the current situation"	0.747				**0.724**	
8 – "*Sinto que controlo a minha situação*" / "I feel in control of my situation"	0.768				**0.752**	
9 – "*Sinto que controlo a minha vida*" / "I feel in control of my life"	0.700				**0.695**	
10 – "*Sinto-me capaz de tomar decisões*" / "I feel able to make decisions"	0.666				**0.664**	
11 – "*Sinto-me capaz de gerir as minhas prioridades*" / "I feel able to manage my priorities"	0.683				**0.604**	
1 – "*Sinto-me seguro*" / "I feel safe"	0.583					**0.686**
2 – "*Sinto-me informado*" / "I feel informed"	0.487					**0.604**
3 – "*Sinto que posso obter o que preciso*" / "I feel that I can obtain what I need"	0.558					**0.671**
4 – "*Sinto-me cuidado(a) por pessoas competentes*" / "I feel cared for by competent people"	0.608					**0.644**
5 – "*Sinto confiança nos outros*" / "I feel trust toward other people"	0.617					**0.648**
6 – "*Sinto que a minha situação está sob controlo*" / "I feel that my situation is under control"	0.567					**0.575**

H^2: Sum of Squared Factor Loadings (proportion of variance explained by the considered factors)

F1, F2, F3, F4 and F5: Values pertaining to the extracted factors

Moreover, when the factors' reliability was estimated, using Cronbach's alpha, we obtained the following values: 0.934 for F1 ("Self-realization and belonging"); 0.914 for F2 ("Normality of life"); 0.841 for F3 ("Spirituality and meaning of life"); 0.901 for F4 ("Control"); and 0.827 for F5 ("Safety"). The overall result was 0.959, demonstrating a considerable internal consistency [25]. Although there is no consensus on the interpretation of this parameter, some authors state that values above 0.70 are ideal, while values below 0.70, but close to 0.60, are satisfactory [25].

After extracting and appraising the five factors, we distributed the scale's 38 items across the newly established categories, instead of employing the seven comfort attributes that had emerged from the concept analysis [9].

Table 4 Descriptive statistics and internal consistency of the GCS-E

Factor Labels	Possible Results	No. of Items	Mean (SD)	Mean Score (SD)	IQR	Cronbach's α
F1 – Self-realization and belonging	11–55	11	42.27 (8.35)	3.84 (0.759)	0.564	0.934
F2 – Normality of life	8–40	8	27.17 (7.38)	3.39 (0.922)	0.570	0.914
F3 – Spirituality and meaning of life	8–40	8	30.34 (5.94)	3.79 (0.742)	0.398	0.841
F4 – Control	5–25	5	17.97 (4.84)	3.59 (0.967)	0.646	0.901
F5 – Safety	6–30	6	21.66 (4.36)	3.61 (0.726)	0.443	0.827
Overall Comfort	38–190	38	139.37 (25.61)	3.64 (0.676)	0.383	0.959

SD: Standard Deviation; IQR: Inter-Quartile Range

Table 5 Pearson's correlation between overall comfort and its factors, and between the considered factors

Factors	F1	F2	F3	F4	F5	Overall Comfort
F1 – Self-realization and belonging	1	0.626**	0.708**	0.656**	0.638**	0.875**
F2 – Normality of life	0.626**	1	0.593**	0.628**	0.451**	0.820**
F3 – Spirituality and meaning of life	0.708**	0.593**	1	0.585**	0.482**	0.811**
F4 – Control	0.656**	0.628**	0.585**	1	0.540**	0.849**
F5 – Safety	0.638**	0.451**	0.482**	0.540**	1	0.741**
Overall Comfort	0.875**	0.820**	0.811**	0.849**	0.741**	1

Table 6 Adjustment indices of the GCS-E

Adjustment Indices	Model's Values	Recommended Values[21, 25, 26]
Chi-square (χ^2)	2884.242 (df = 660)	
Comparative Fit Index (CFI)	0.811	> 0.80
Akaike Information Criterion (AIC)*	41273.366	
Root Mean Square Error of Approximation (RMSEA)**	0.086	< 0.050 / 0.060
Standardized Root Mean Square Residual (SRMR)*	0.066	< 0.08
Goodness of Fit Index (GFI)	0.739	> 0.80
Bentler-Bonett Non-Normed Fit Index (NNFI) / Tucker Lewis Index (TLI)	0.798	0.95
Parsimony Normed Fit Index (PNFI)	0.721	
Expected Cross-Validation Index (ECVI)*	6.725	

df: degrees of freedom; *model's lowest results; **90% Confidence Interval

For the elderly individuals who participated in the study, comfort was mainly achieved through "Self-realization and belonging" (F1), reflecting a realistic self-perception, combined with self-satisfaction and feeling/giving oneself to others [9]. In this sense, while Veludo considered two categories ("Self-realization" and "Belonging"), our factor analysis produced a single factor, which encompassed 11 items and was named "Self-realization and belonging". The amalgamation of these two concepts may echo an existing connection between them – "Belonging" facilitates "Self-realization" (by providing an accepting and supportive environment), being also a vital need that influences self-esteem and self-control [30].

As to "Normality of life", it comprises eight items and reflects the individuals' ability to live in accordance with their routines [9]. The items' allocation during the factor analysis matched the distribution previously made in the literature review [9], except for the item "I feel able to help others", which Veludo included in the category "Belonging". Since helping others can be a significant part of a person's daily routine, we preferred to include the aforesaid item in the factor "Normality of life". The capacity to help others affects various dimensions of our well-being (individual, social and organizational). Furthermore, it can have a considerable bearing on our sense of purpose, social connections, and overall satisfaction with life [31].

On the other hand, "Spirituality and meaning of life", which also encompasses eight items, matches Veludo's "Peace and Fullness", except for the item "I feel good the way I am" (incorporated into "Self-realization" within the literature review) [9]. The spiritual dimension plays a crucial role in the lives of elderly individuals, by facilitating the comprehension of numerous meanings, the withstanding of negative circumstances, and the perpetuation of positive emotions. Consequently, spiritual well-being has a positive impact on the individuals, as it can grant them peace, hope, freedom, and happiness, while improving their relationships, work-life balance, and global welfare [30]. Hence, we decided to include the aforesaid item in the factor "Spirituality and meaning of life".

As regards "Control", it refers to dominating/having power over the current events [9]. The items we incorporated into this factor are in line with those selected by Veludo for the namesake category [9].

Lastly, the factor "Safety", which comprises six items, is associated with a sense of protection and predictability [9]. Although we included the item "I feel that my situation is under control" in this factor, Veludo placed it

in the category "Control". Our choice was based on the overall perception conveyed by the statement in question.

The five factors that constitute the GCS-E encompass various items, which are connected with different contexts (physical, psychospiritual and sociocultural) found in Katherine Kolcaba's taxonomic structure [6]. However, it should be noted that this instrument only measures the experienced comfort levels (attributes), not taking into consideration the involved facilitators (antecedents). Therefore, it overlooks relevant indicators identified in the abovementioned framework, such as those related to environmental conditions [6].

Our findings demonstrate that the GCS-E can be used as a support tool, during diagnostic stages, to assess the patients' overall comfort levels. Moreover, through its diverse items, it can be employed to identify specific discomforts experienced by chronically ill elderly individuals. This allows implementing targeted measures, while evaluating the effect of nursing interventions as regards comfort promotion.

Limitations

Regardless of its scientific value, this work presents some limitations, namely: the sample was selected through non-probability sampling, thus deriving from an intentional sampling methodology; the scale was validated at a local level, rather than at a national level; and, due to the study's cross-sectional nature, neither a prospective predictive validation, nor a temporal stability assessment, were feasible. Therefore, the outcomes of cross-sectional studies can only draw conclusions about associations and not causation between variables.

Conclusions

When associated with chronic illness, the experience of ageing often generates discomfort. By identifying the factors that originate a sense of comfort, health care professionals (especially nurses) can define new strategies for their practice. In elderly individuals with chronic diseases, this results in quality improvements, as regards the provided care.

The scale developed during our study (the GCS-E) comprises 38 items, which are distributed among five factors. It is a practical and reliable tool for measuring comfort levels in the target population. Our findings substantiated its validity and reliability, thus portraying adequately the studied construct. We recommend further research on this topic, including a new exploratory factor analysis, with the aim of confirming the structure produced in our study. Moreover, the scale's test-retest reliability and convergent validity should be appraised, using other samples (which should encompass individuals from various age groups, with/without diseases, and from different regions of Portugal).

Abbreviations

GCS-E	Global Comfort Scale – Elderly – Portuguese Version
I-CVI	Item Content Validity Index
Ic-CVI	Items' clarity
Ip-CVI	Items' pertinence
Ir-CVI	Items' relevance
S-CVI	Scale Content Validity Index
SPSS	Statistical Package for Social Sciences
JASP	Jeffreys's Amazing Statistics Program
GFI	Goodness of Fit Index
CFI	Comparative Fit Index
SRMR	Standardized Root Mean Square Residual
RMSEA	Root Mean Square Error of Approximation
PNFI	Parsimony Normed Fit Index
NNFI	Bentler-Bonett Non-Normed Fit Index
TLI	Tucker Lewis Index
ECVI	Expected Cross-Validation Index
AIC	Akaike Information Criterion
SD	Standard Deviation
KMO	Kaiser-Meyer-Olkin
H^2	Sum of Squared Factor Loadings
F1	Factor no. 1 ("Self-realization and belonging")
F2	Factor no. 2 ("Normality of life")
F3	Factor no. 3 ("Spirituality and meaning of life")
F4	Factor no. 4 ("Control")
F5	Factor no. 5 ("Safety")
IQR	Inter-Quartile Range
χ^2	Chi-square
df	degrees of freedom

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12912-025-02999-w.

Supplementary Material 1

Acknowledgements
Not applicable.

Author contributions
RM: Conceptualization; Investigation; Formal analysis; Software; Methodology; Writing – original draft; and Writing – review & editing. FV: Conceptualization and Writing – review & editing. PPS: Conceptualization and Writing – review & editing. MAD: Conceptualization; Formal analysis; Software; Methodology; Writing – original draft; and Writing – review & editing.

Funding
This research effort did not receive any specific grants from funding agencies (state/public, commercial, nonprofit, or not-for-profit).

Data availability
Data is provided within the manuscript or supplementary information file.

Declarations

Ethics approval and informed consent to participate
This study was approved by the institutional ethics committee of Universidade Católica Portuguesa (Approval no. 91/2020). Before the survey, an informed consent was obtained from all the participants, by means of a consent form. All the employed methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 15 December 2024 / Accepted: 18 March 2025
Published online: 04 April 2025

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