

Original Research Article

# Definition and Contextual Factors of Nursing Home Residents' Mobility in a Holistic View: A Delphi Study

Oliver Vogel, PhD,<sup>1, ID</sup> Ann-Kathrin Otto, MA,<sup>1</sup> Hanna Zimmel, BSc,<sup>1</sup> Timo Hinrichs, MD,<sup>2, ID</sup>  
Eleftheria Giannouli, PhD,<sup>3,\* ID</sup> and Bettina Wollesen, PhD<sup>1</sup>

<sup>1</sup>Department of Human Movement Science, University of Hamburg, Hamburg, Germany. <sup>2</sup>Department of Sport, Exercise and Health, University of Basel, Basel, Switzerland. <sup>3</sup>Department of Health Sciences and Technology and Motor Control and Learning Group, Institute of Human Movement Sciences and Sport, ETH Zurich, Zurich, Switzerland.

\*Address correspondence to: Eleftheria Giannouli, PhD, ETH Zurich, Department of Health Sciences and Technology, Institute of Human Movement Sciences and Sport, Leopold-Ruzicka-Weg 4, 8093 Zurich, Switzerland. E-mail: [eleftheria.giannouli@hest.ethz.ch](mailto:eleftheria.giannouli@hest.ethz.ch)

Received: July 6, 2022; Editorial Decision Date: October 16, 2022

**Decision Editor:** Lena K. Makaroun, MD, MS

## Abstract

**Background and Objectives:** Current definitions of older adults' mobility do not cover the full range of influencing factors and do not consider nursing home residents. The present study reports expert ratings from a Delphi study regarding factors influencing the mobility of long-term nursing home residents.

**Research Design and Methods:** We invited 129 professionals with expertise in a field relevant to research on mobility in older adults such as health care, medicine, or human movement science to participate in a Delphi study comprising 3 rounds of online questionnaires. Up to 40 experts participated in each round. In the first round, we used open-ended questions to solicit possible definitions, contextual factors, and assessment tools. In the second round, the participants used Likert scales (1–10) to rate their suitability. In the final round, we presented a definition based on consensus as well as the top-rated contextual factors and assessment tools from the first 2 rounds for a final rating of agreement.

**Results:** The experts showed broad agreement on the final version of the mobility definition, with  $8.9 \pm 1.4$  (mean  $\pm$  standard deviation) out of 10 points. The experts also showed broad consensus on the selected contextual factors, with  $8.4 \pm 1.8$  points to  $8.9 \pm 1.2$  points (out of 10 points). This was also the case for the top 3 assessment tools selected from results of previous rounds, which showed an agreement of 7 or more points (out of 10 points) by 81.6% to 100% of all experts in the different categories.

**Discussion and Implications:** Given that an interdisciplinary group of experts considered various hitherto neglected contextual factors as relevant, the Delphi survey and its results imply the need for an updated interdisciplinary and holistic understanding of mobility in nursing home residents and can provide a basis for putting it into practice.

**Translational Significance:** Current definitions of older adults' mobility do not cover the full range of influencing factors and do not consider nursing home residents. This study updates the current understanding of mobility, the factors influencing it, together with suitable assessment tools suggested and/or approved by interdisciplinary international experts. Future research on mobility and the promotion of mobility in practice may benefit from a holistic overview of influencing factors and a selection of appropriate assessment tools.

**Keywords:** Activities of daily living, Health promotion, Immobility, Independence, Long-term care

The increasing life expectancy of adults aged 65 and older is not only leading to a rising number of nursing home residents but is also posing an increasing public health burden (1). The growing care dependency and morbidity accompanying the aging process affect public health systems as evidenced by exploding health costs. Good health in later life and an independent lifestyle are inextricably linked to the mobility of older adults (2). While immobility or mobility limitations (eg, difficulty climbing stairs or limited walking distance) negatively affect health status and independence, promoting mobility can counteract detrimental age-related processes in the aging population (3). Therefore, the importance of mobility in older adults in general, and in nursing home residents in particular, is increasing in line with the demographic change.

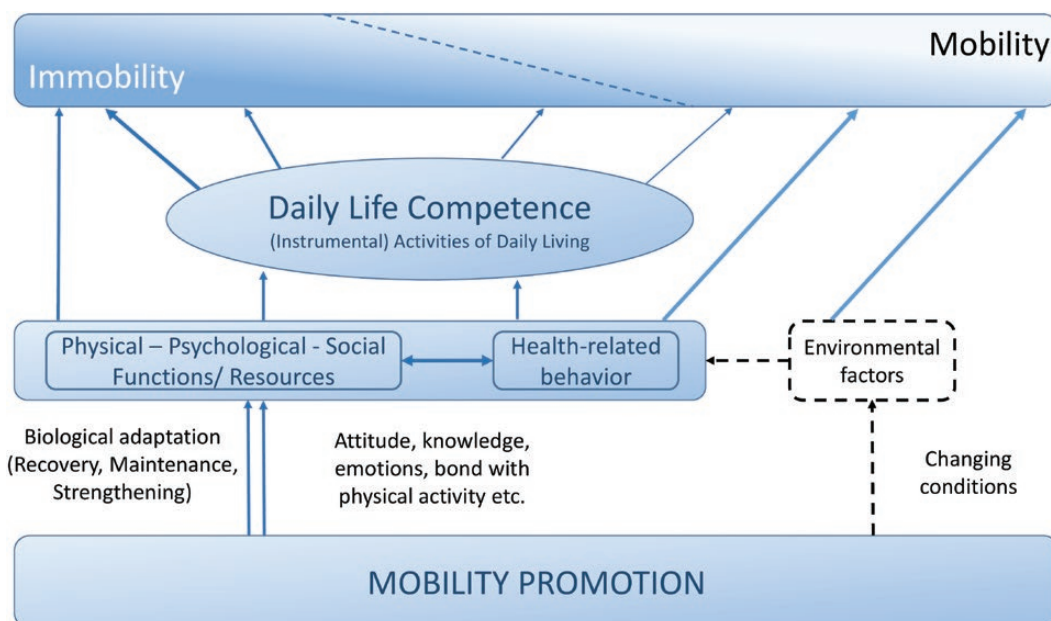
Mobility is often equated with the ability to walk or to climb stairs (4). In the World Health Organization's (WHO) International Classification of Functioning (ICF) model, mobility comprises activities such as "moving by changing body position or location or by transferring from one place to another, by carrying, moving or manipulating objects, by walking, running or climbing, and by using various forms of transportation" (see Figure 1: Physical functions/resources) (5). While the ICF highlights the interdependence of activities with body functions and structures, participation, as well as personal and environmental factors, it does not give any guidance on the specific factors that are relevant for mobility; nor are these specific factors integral elements of the definition of mobility (see Figure 1: Health-related behavior; environmental factors). In the interest of a holistic conceptualization that brings together all possible influencing factors,

this definition appears to be incomplete. In addition to the restricted view of mobility, relevant assessment tools have often been limited to instruments that assess physical functions such as balance, leg strength, or the ability to walk (6).

A broader description of the term "mobility" includes influencing factors beyond physical factors (7). The theoretical framework by Webber et al. (7) expands the understanding of mobility to include various categories such as cognitive, psychosocial, environmental, and financial influences. Webber et al.'s research (7) describes community-dwelling older adults and does not consider all relevant mobility factors in care-dependent older adults, such as the specific circumstances of nursing home residents. The prevailing definition of mobility may overlook factors exclusive to this setting, such as restrictive clothing and the lack of mobility devices (eg, walkers; compare Figure 1: Changing conditions of environmental factors). Therefore, currently prevailing definitions still do not serve as exhaustive definitions and do not consider nursing home residents.

Contextual factors (cognitive, psychosocial, physical, environmental, and financial influences) affect and, in turn, promote or inhibit mobility. This includes the accumulation of multimorbidity and functional losses resulting from increasing life expectancy (8). Low mobility levels or immobility indicate care dependency and negatively influence the progression of diseases (see Figure 1: Daily life competence) (9).

Mobility limitation is a risk factor for decreased activities of daily living (ADL) skills and health-related quality of life, increasing functional and cognitive decline, as well



**Figure 1.** Holistic mobility model modified from Pfeifer et al. (53). The figure shows the direct effect of daily life competence on mobility, as well as direct and indirect (via daily life competence) relations to contextual factors such as physical, psychological, and social resources, health-related behavior, and the environment. The figure also indicates the factors that could be affected by mobility-promotion measures.

as social isolation (see Figure 1) (3). Insufficient physical activity and ensuing mobility restrictions increase the risk of muscle loss, frailty, and falls (10,11).

Factors directly and indirectly affecting mobility in later life and also affect each other include:

- Cognitive capacity and cognitive impairment (eg, dementia can promote or inhibit the need to move) (12).
- Fear of falling and motivation to move (eg, insecure gait can restrict life space) (10).
- Social surroundings (eg, arranging activities such as group walks with peers can increase physical activity) (13).
- Loneliness, depression, and perceived low quality of life (eg, newly widowed individuals may lack the drive to move around) (14).
- Institutional factors such as nurses' workload, attitude, and skills (eg, nurses' heavy workload may limit the time required to mobilize residents) (15–17).

A holistic view of mobility in nursing home residents has rarely been applied when designing studies or selecting appropriate assessment tools for evaluating the effect of interventions. Furthermore, current efforts to digitalize mobility tracking fail to take various contextual factors of mobility into account. For example, accelerometry reflects physical activity as an outcome of mobility, without taking subjective factors such as motivation into account. However, research related to mobility is aligned with the general understanding of mobility. The range of contextual factors considered relevant for nursing home residents' mobility determines the outcomes and corresponding instruments integrated into related studies. Furthermore, interdisciplinary cooperation requires a common understanding of mobility of institutionalized older adults.

To adapt future research on nursing home residents to a new understanding of mobility in line with a holistic mobility model, an updated definition of nursing home residents' mobility is needed that includes relevant contextual factors and corresponding valid assessment tools related to long-term care. Figure 1 presents a possible graphic representation of such a holistic model.

For this study, we assumed that the understanding of nursing home residents' mobility would vary among experts from different professions such as human movement science and health care professionals. This means that a holistic definition should incorporate various interdisciplinary perspectives. To achieve a consensus and a holistic definition of mobility, including all relevant influencing measures and facets, a Delphi study is a suitable method (18). This study therefore uses a Delphi survey to incorporate various important perspectives from different professions for investigating the main objectives:

- (1) Developing a holistic definition of nursing home residents' mobility.
- (2) Identifying the relevant contextual factors that affect mobility in nursing homes.
- (3) Compiling appropriate assessment tools for recording mobility and contextual factors in nursing homes.

We hypothesize that the results of this study will lead to an updated understanding of the existing model that will also describe nursing home residents' mobility and include the interaction of contextual factors. We also expect this study to complement conventionally accepted key aspects of promoting mobility and respective measurements.

## Method

### Study Design

This Delphi survey included 3 rounds of online responses and was conducted according to the recommendations of Trevelyan and Robinson (18). Ethical approval was granted by the responsible institutional Ethics Committee (No. 2021\_397). Informed consent was obtained from all participants in accordance with the Declaration of Helsinki (2018) prior to completing each questionnaire. Data collection took place between September and October 2021.

### Participants

Based on recommendations in the literature, the targeted sample size was determined to be at least 8–15 participants (18–20). Due to the heterogeneity of professions among the participants, no maximum sample size was set.

Inclusion criteria comprised only expertise in a field relevant to research on mobility in older adults such as health care, medicine, or human movement science.

For our purpose, we defined human movement science as any academic discipline that focuses on the scientific study of the (patho)physiology, biomechanics, motor control, or psychology of human movement and exercise (eg, sports medicine, biomechanics, sport, and movement gerontology).

We recruited potential experts via personal networks or peer-reviewed publications on mobility in nursing home settings. We initially e-mailed 109 international interdisciplinary experts from 15 countries with invitations to participate. In addition, in the first questionnaire, we asked participants to suggest additional suitable experts, so that  $N = 129$  experts were invited to participate in rounds 2 and 3.

The following occupational groups were represented: human movement science ( $n = 32$ ; ie, sports science, biomechanics, sport, and movement gerontology), nursing science ( $n = 18$ ), geriatrics ( $n = 12$ ), physiotherapy ( $n = 11$ ), rehabilitation ( $n = 10$ ; rehabilitation science, occupational therapy), health care/sciences ( $n = 8$ ), medicine ( $n = 7$ ), psychology ( $n = 4$ ), and others ( $n = 10$ ). In addition, 25 of the participants had additionally completed practical nursing

training and were employed to some extent in the nursing profession.

### Study Flow

Each potential participant received an e-mail with a letter of invitation outlining the content and purpose of the study and the link to access the respective questionnaire. A video explained the Delphi process and aspects of data privacy for subsequent rounds. Each round of the Delphi survey comprised an online questionnaire created with the LimeSurvey software (LimeSurvey GmbH, Hamburg, Germany). The LimeSurvey survey tool and the content of the questionnaire were tested and approved by various volunteers in an experimental survey. The 3 rounds were conducted at 3-week intervals. Each questionnaire was supposed to be completed within 1 week. The results were then analyzed and incorporated into the next round within 2 weeks (Figure 2).

Participants who did not return the questionnaire within 4 days received an e-mail reminder asking whether they still intended to participate.

### Questionnaires

Prior to initiating the Delphi study, we used qualitative interviews to determine the currently prevailing understanding of mobility in nursing homes. The interviews showed that the definition was limited to physical functions.

The first round of the Delphi survey included 4 steps:

- (1) Using open-ended questions to elicit participants' understanding of mobility in nursing home residents.
- (2) Using open-ended questions to collect relevant factors influencing mobility and respective assessment tools.
- (3) Rating contextual factors identified in the literature (eg, health and fitness, cognition and emotion) on 10-point Likert scales (1 = not suitable; 10 = very suitable). Contextual factors were included in the next round if they scored ratings above 7 points by more than 75% of the participating experts.
- (4) Request to suggest further potential participants with expertise in a relevant field for inclusion in the following rounds.

The questionnaire was piloted in a small group of experts within the personal networks of the study directors.

Based on the results of the first round, 2 further differentiated definitions of mobility were synthesized.

The second round comprised the following:

- (1) Rating of agreement with 2 given definitions (1 = no agreement; 10 = full agreement).
- (2) Rating of influencing factors compiled in the first round with regard to their relevance for mobility in nursing home residents (10-point Likert scale; 1 = not important; 10 = very important).
- (3) Rating of the assessment tools named by the experts in the first round with regard to their suitability for measuring respective contextual factors (1 = not suitable; 10 = very suitable).

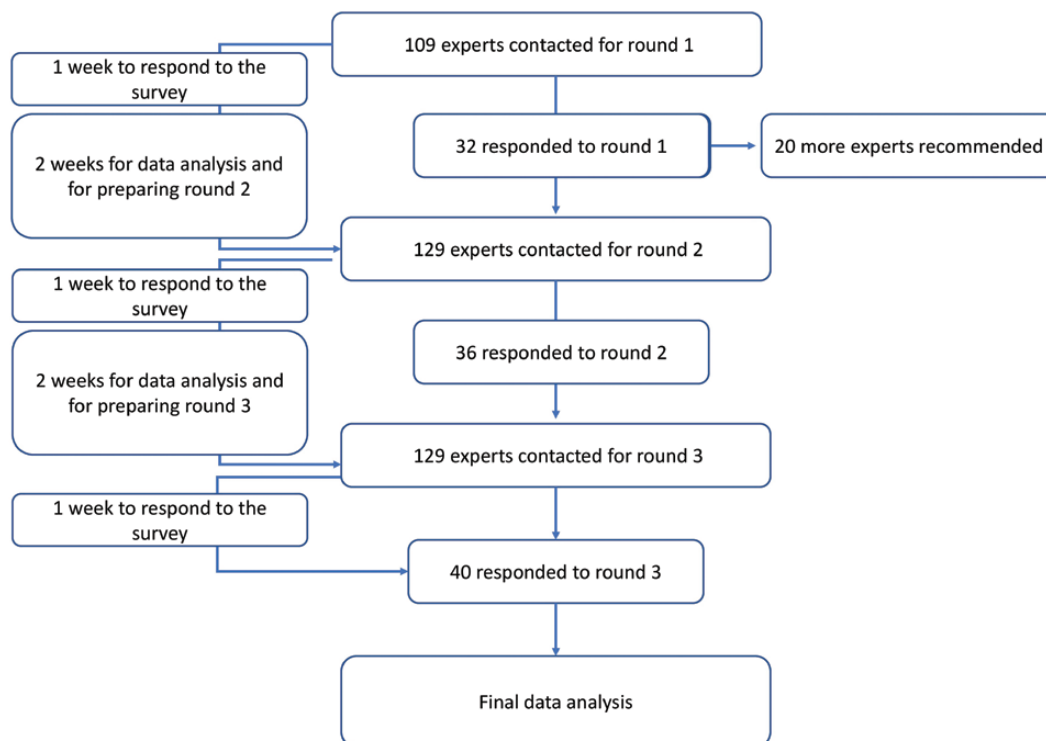


Figure 2. Study flow chart.

- (4) Option for experts to add free-text comments to each rating with regard to definitions, contextual factors, and assessment tools.

Basic test details of the assessment tools, including the tested dimensions, the test duration, the number of tests/items, the individual to be questioned, and validity, were provided.

The third and final round offered the following:

- (1) A single final definition of nursing home residents' mobility for rating of agreement to achieve a consensus (10-point Likert scale).
- (2) The rating from round 2 yielded a selection of important contextual factors for nursing home residents' mobility which was rated for agreement.
- (3) The rating from round 2 yielded a top 3 ranking of suitable assessment tools per contextual factor, which was also rated for agreement.
- (4) Experts were able to add free-text comments to each rating.

The definitions and selections regarding contextual factors and assessment tools of each subsequent round were based on the results of the previous round. In addition, all of the ratings from round 3 provided free-text comments for specifying and/or clarifying ratings or disagreements with the given answers. After the final round, we invited all experts to be mentioned in the publication (see Acknowledgments).

Each questionnaire took about 10 to 15 minutes to complete.

### Data Processing and Analysis

The survey provided qualitative and quantitative results. The qualitative results were summarized and categorized according to Mayring (21). The results were assigned to the following categories:

- Additions of missing contextual factors;
- Feedback regarding the lack of specificity of the factors provided in the questionnaire;

- Additions of missing assessment tools; and
- Concerns regarding the provided assessment tools.

Quantitative results were analyzed for frequencies, means, and standard deviations. Mann–Whitney *U* tests were used to analyze differences between participants from different professions.

For statistical analysis, data were imported to SPSS Version 27 (IBM SPSS Statistics, Armonk, NY). The participants' professions were categorized as exercise science background (including human movement science and physiotherapy), or other (nursing science, health care professionals).

## Results

### Sample Characteristics

The total participation per round and distribution of professions among the participants in each round are presented in Table 1.

### Definition

The definitions of mobility in nursing home residents stated by the participants in the first questionnaire included the following keywords in different constellations and frequency of mention:

- Locomotion (moving from place A to B; *n* = 15).
- Independence (regarding moving and living; *n* = 11).
- Functional ability (ie, to stand up, move body parts; *n* = 10).
- Possible use of mobility devices (ie, walking aids; *n* = 4).
- Quality of life (*n* = 3).
- Participation (*n* = 3).
- Social involvement (*n* = 2).

Two differentiated definitions of mobility, based on the types of understanding stated in round 1, were rated in round 2 as follows. The first definition was rated by experts with 7.9 points (1–10 scale) and the second definition with 7.3 points (1–10 scale).

**Table 1.** Participation per Delphi Round and Profession of the Sample

Professions	Participation Round 1 (%)	Participation Round 2 (%)	Participation Round 3 (%)
Human movement science	13 (40.6%)	12 (33.3%)	15 (37.5%)
Physiotherapy	5 (15.6%)	7 (19.4%)	7 (17.5%)
Psychology	3 (9.4%)	1 (2.8%)	1 (2.5%)
Medicine	1 (3.1%)	2 (5.6%)	3 (7.5%)
Rehabilitation	1 (3.1%)	4 (11.1%)	1 (2.5%)
Nursing science	2 (6.3%)	3 (8.3%)	4 (10.0%)
Geriatrics	3 (9.4%)	4 (11.1%)	7 (17.5%)
Health care/science	2 (6.3%)	1 (2.8%)	0 (0%)
Others	2 (6.3%)	2 (5.6%)	2 (5.0%)
Total	32 (100%)	36 (100%)	40 (100%)

### Definition 1

Mobility is the ability to freely and independently move oneself around. This includes being able to transfer (e.g., out of bed, from bed to chair, sitting, standing), being capable of moving around in someone's environment as well as being physically active.

### Definition 2

Mobility is the ability to participate unrestrictedly in activities of daily living, being able to maintain a social life, and having access to vital facilities (e.g., health care facilities, food shops ...) while perhaps using assistive devices, such as walking aids, wheelchairs, scooters, public transportation as well as other vehicles and support resources.

The isolated phrases most frequently mentioned in the first round were rated regarding their suitability for an updated definition of nursing home residents' mobility as follows: Participants agreed with "Functional ability (ie, to stand up/move body parts)" with a 91.5% agreement rate; 89.6% agreed to "Locomotion (moving from place A to B)"; 66.0% to "Including the use of aids (eg, walking aids)"; 52.1% to "Independence (regarding moving and living)"; 42.6% to "Participation and social involvement"; and 40.4% to "Quality of life."

The final wording of an updated mobility definition for nursing home residents, based on the results of the first 2 Delphi rounds, was rated with 7 or more points (10-point Likert scale) by 87.2% of the participants answering the third questionnaire. The mean rating and standard deviation were  $8.9 \pm 1.4$  points ( $M \pm SD$ ). The rated definition reads as follows:

Mobility is the ability to freely and independently move oneself around (e.g., transfer out of bed, sitting, standing, moving around in the environment), to participate unrestrictedly in activities of daily living and social life and having access to vital life spaces (e.g., dining room, hairdresser) while perhaps using assistive devices, such as walking aids, wheelchairs, scooters, public transportation as well as other vehicles and support resources.

While participants from professions related to human movement sciences rated their agreement with the final definition with 9.04 (out of 10) points, participants from other professions rated their agreement with 8.6 (out of 10) points. However, there was no significant difference between professions with regard to agreement with the given definition ( $p > .05$ ).

### Contextual Factors and Assessment Tools

Regarding their importance for nursing home residents' mobility and suitability for measurements, the selection of contextual factors and assessment tools based on the results

of the first 2 rounds were rated on 10-point Likert scales (1 = not important, 10 = very important). The exhaustive list of contextual factors and assessment tools is presented in [Supplementary Tables 1–6](#). The ratings are presented in [Table 2](#).

No significant differences regarding the rating of the final definition, contextual factors, or assessment tools were observed among the 2 groups of professions.

### Discussion

This Delphi study pursued 3 objectives: (i) to generate a holistic definition of nursing home residents' mobility based on experts' opinions, (ii) to identify its relevant contextual factors, and (iii) to identify appropriate assessment tools.

In addition to previous studies, the present study particularly addressed nursing home residents' mobility with focus on a holistic definition that would consider all possible aspects of mobility in this setting. The results showed high agreement with the final definition, which includes the ability to move around freely, participate in ADL and social life without any restrictions, and access vital life spaces with mobility devices, etc. In addition, the experts indicated, for example, mobility-related skills, frailty, motivation, social isolation and participation, and skills, knowledge, motivation on the part of nurses as contextual factors that influence the mobility of nursing home residents. The participants rated assessment tools such as the Timed Up and Go Test (22), Fried's Frailty Scale (23), Motivation Assessment Scale (24), University of California, Los Angeles (UCLA) Loneliness Scale (25), or open-ended interviews as suitable for identifying relevant contextual factors.

### Definition of Mobility

The experts' understanding of mobility in nursing homes elicited in the first round represented the prevailing view on mobility from the perspective of physical function (4,7). Webber et al. (7) was the most often cited source in the first round; they define mobility more broadly than previous studies. Despite the advances with respect to a holistic understanding of mobility, the framework of Webber et al. (7) fails to take all relevant factors into account. The incompleteness of even the most advanced framework underlines the need for an updated definition of nursing home residents' mobility.

The currently prevailing understanding of mobility is reflected in the rating of suitable phrases for a definition. While physical aspects such as functional ability and locomotion garnered high agreement of approximately 90%, the experts did not agree as strongly with other aspects worded in the phrases. In contrast, while the use of aids for locomotion was still endorsed by two-thirds of the experts, independent living, participation, and social involvement, as well as quality of life only found approval by half or less of the surveyed cohort. Combining the expertise of the

**Table 2.** Agreement With the Top 3 Rated Assessment Tools for the Respective Contextual Factor

Domain	Contextual Factor (% of ratings ≥7)	Best-Rated Instruments	Instrument Selection Rating ( <i>M</i> ± <i>SD</i> )
Functional capacity	Mobility (84.4%)	Timed Up and Go Six-Meter Walking Test Short Physical Performance Battery	8.5 ± 1.9
Health status	Frailty (100%)	Fried's Frailty Scale Frailty Index Groningen Frailty Scale	9.5 ± 0.8
	Falls (96.3%)	Care home records Past Fall History (Screening Q) Fall detector devices	9.0 ± 1.0
	Physical fitness (90.3%)	Six-Minute Walking Test Timed Up and Go Gait velocity	8.3 ± 1.7
Cognition and emotion	Health status (88.0%)	WHO Disability Assessment Schedule Short-Form F12/Short-Form 36 Euroqol 5 Dimension 5 Level Questionnaire (EQ-5D-5L)	8.7 ± 2.1
	Action control/awareness (100%)	Sense of Control Scale Fall-Related Impulsive Behavior Scale Treatment Self-Regulation Q (TRSQ)	9.1 ± 1.1
	Motivation (100%)	Motivation Assessment Scale Intrinsic Motivation Inventory Health Action Process Approach	8.9 ± 1.1
	Cognitive impairment (96.7%)	Montreal Cognitive Assessment Mini-Mental State Examination Addenbrooke's Cognitive Examination	9.1 ± 1.1
	Life satisfaction (94.4%)	Satisfaction with Life Scale Dementia Specific Quality of Life Questionnaire (QUALIDEM) WHO Quality of Life Scale (Alzheimer's disease; WHOQOL[AD])	9.2 ± 1.1
	Depression (92.0%)	Geriatric Depression Scale Center of Epidemiological Studies— Depression Scale (CES-D) Patient Health Questionnaire 4/8/9	8.9 ± 1.5
Social and leisure	Social isolation and participation (100%)	UCLA Loneliness Scale Social Connectedness Questionnaire Maastricht Social Participation Profile	9.5 ± 0.7
	Opportunities and occasions (88.9%)	Older People's Quality of Life Questionnaire (OP-QOL) Late Life Function and Disability Instrument Health and Retirement Study Quest.	8.7 ± 1.5
Institutional/ environmental factors	Competencies, knowledge, motivation of nurses (100%)	Open-ended interviews Observing corporate culture Screening of residents' weekly schedules	9.2 ± 1.1
	Structural resources (92.9%)	Special Care Unit Environment Quality Scale (SCUEQS) Housing Enabler German Environmental Audit Kit (G-EAT)	8.7 ± 1.5
	Movement restrictions (91.3%)	Observation Barthel Index Life Space Assessment	9.1 ± 1.3

Notes: *M* = mean; *SD* = standard deviation; WHO = World Health Organization; UCLA = University of California, Los Angeles.

participants changed the definition from having a narrow view in the first round to a broader perspective, resulting in a more holistic final definition. After linguistic editing this definition reads as follows:

Mobility is the ability to freely and independently move oneself around (e.g., transfer out of bed, sitting, standing, moving around in one's surroundings), to participate in activities of daily living and one's social life without any restrictions and have access to vital life spaces (e.g., dining room, hairdresser) while possibly using mobility devices such as walking aids, wheelchairs, scooters, or support such as public transportation, as well as other vehicles and support resources.

This definition of nursing home residents' mobility given in the third round reached a high level of agreement. Regardless of their profession, experts agreed on the given definition as a valid holistic understanding of nursing home residents' mobility. Excellent ratings across all professions indicate consensus for updating the current understanding of mobility. The definition resulting from the Delphi process provides a holistic understanding applicable across disciplines while integrating hitherto neglected aspects.

Surveying members of various professions meets the requirements of interdisciplinary and comprehensive research on mobility concerns, as well as more complex strategies for addressing these concerns (7).

A more holistic definition of mobility, specifically for residents living in long-term care, may lead to a more comprehensive evaluation of their mobility skills that would include the factors that support or hinder safe mobility. Therefore, promoting mobility and preventing immobility can benefit from a more holistic understanding of mobility. Cases of immobility due to factors other than physical disability did not offer a direct approach for health promotion measures following the previous narrow views of nursing home residents' mobility. Considering a greater variety of factors as possible causes of immobility can potentially increase the likelihood of successfully promoting mobility. These factors causing mobility or immobility add up to a holistic understanding of mobility. Research on the range of factors influencing mobility and corresponding assessment tools has already been called for in the current literature in the field of mobility research (26,27). The results regarding contextual factors are discussed below.

### Contextual Factors

The 4 key domains proposed by the research group, as well as the associated contextual factors were approved by the surveyed experts. Previous research showed that nursing home residents restrict their mobility behavior due to cognitive, emotional, physical, environmental, and social influences (11,28,17).

Additional factors complemented by the participants indicate the incompleteness of previous definitions that were limited to locomotion or physical movement. However, to date, no study has combined the knowledge of interdisciplinary experts to standardize a more holistic understanding of mobility in nursing home residents. Therefore, researchers and practitioners most likely took additional relevant factors for mobility related to their expertise into account in daily work that were not included in the prevailing definition. Thus, the interpretation of mobility most likely differed among members of different disciplines, leading to various deviating and incomplete definitions of mobility across disciplines. To our knowledge, the present study is the first to present a definition and selection of contextual factors derived by consensus by experts from a broad range of disciplines.

### Assessment Tools

The assessment tools gathered and rated throughout the Delphi process met general approval.

Furthermore, the experts' choice of instruments coincides with previous studies investigating related topics. For example, the Timed Up and Go Text, Six Meter Walking Test, and Short Physical Performance Battery have frequently been used in research on older adults' mobility (29). The best-rated tools for assessing frailty (Fried's Frailty Scale, Frailty Index, Groningen Frailty Scale) have been validated and investigated multiple times in related literature, indicating their presence and relevance in related research (30,31). The experts' selection of instruments for assessing physical fitness has also been identified as appropriate for investigating older adults in a review on related studies (32). The WHO Disability Assessment Schedule, SF12/36, and Euroqol 5 Dimension 5 Level Questionnaire (EQ-5D-5L) mentioned by the experts can also be found in the literature as typical and validated tools for assessing older adults' health status (33,34). The Montreal Cognitive Assessment, Mini-Mental State Examination, and Addenbrookes's Cognitive Examination were mentioned most frequently for assessing cognitive impairment and had the best performance in different cultures and countries (35,36). Among the tools for measuring motivation, the Intrinsic Motivation Inventory was mentioned, which is already used in the context of nursing homes (37). Furthermore, the Satisfaction with Life Scale, Dementia Specific Quality of Life Questionnaire (QUALIDEM), and World Health Organization Quality of Life Scale-Alzheimers Disease (WHOQOL(AD)) are tools for measuring life satisfaction that have been shown to be useful in the related literature (38–40). The highest-rated depression assessment tools (Geriatric Depression Scale, Center of Epidemiological Studies—Depression Scale (CES-D), Patient Health Questionnaire 4/8/9) are frequently used in research and have been found to be valid for use with older adults (41–43). For the social



isolation measurement tools (UCLA Loneliness Scale, Social Connectedness Questionnaire, Maastricht Social Participation Profile), the literature confirms their use in the nursing home setting (44–46). The Special Care Unit Environment Quality Scale (SCUEQS), Housing Enabler, and German Environmental Audit Kit (G-EAT) are tools developed to assess the structural resources of nursing home settings and are therefore typically used in this field of research (47–49).

The level of agreement with the assessment tools that were mentioned and subsequently selected was high across all experts. However, suggested methods for assessing movement restrictions and corporate culture (the institution management's knowledge and attitude regarding residents' mobility) tended to involve vague concepts rather than valid instruments. The answers regarding assessment tools for the abovementioned factors included "open interviews," "observation," and "observing corporate culture." These approaches might work for individual cases when collecting qualitative data. However, in terms of creating a comprehensive but compact standardized assessment tool, we do not consider these approaches to be feasible. The lack of knowledge about appropriate standardized instruments for measuring isolated contextual factors underlines the missing integration of respective outcomes in practice to date.

The major methods used to assess the knowledge and skills of nurses represent merely qualitative instruments such as observations. While they provide detailed results for individuals, qualitative methods lack important information for large-scale comparability. Furthermore, qualitative instruments take more time to complete, making their use in large cohorts more complicated. In contrast to qualitative methods, quantitative methods allow practitioners to refer to reference values (norms), guidelines, and cutoff scores. Hence, quantitative methods enable comparability of results and therefore benefit interdisciplinary cooperation.

The methods and instruments reported for capturing contextual factors in the field of physical function, cognitive capacity, and social aspects coincide with the tools used in previous studies (27,50,51).

### Differences Between Professions

To assure the generalizability of our results and rule out any bias owing to the fact that the majority of experts in our sample are human movement scientists, we checked for possible deviations in the ratings by members of different professions. Despite the various initial definitions of nursing home residents' mobility, the evaluation of different professions' ratings in the third round yielded similar results regarding their agreement with the final definition. This means that the experts' backgrounds did not influence their agreement with the final definition. Consequently, despite their originally divergent understanding of mobility, all surveyed professions agreed with

the holistic definition in the final round of the Delphi process. Therefore, the updated definition does not appear to contradict any experts' understanding but rather broaden it. This integration of various disciplines to adopt a holistic definition based on consensus will potentially benefit interdisciplinary research in particular. To our knowledge, apart from the work of Webber et al. (7), no study in this area to date has compiled the contributions of members from an extensive range of professions. However, there has already been a call for a combination of different traditions in understanding mobility in the relevant literature (52).

### Impact and Relevance

The experts indicated a high level of agreement with the final definition and the contextual factors, highlighting the importance of the updated definition and understanding of mobility in nursing home residents.

The new theoretical framework recognizes that mobility must be defined more broadly and include more aspects than the ability to walk or climb stairs (4).

The model may encourage new research to consider the holistic approach toward nursing home residents' mobility when designing interventions and selecting appropriate assessment tools for evaluation. Therefore, the results of this study can be used to derive more specific recommendations for effective promotion of safe mobility, prevention of immobility and falls in nursing home residents, and to disseminate these to the scientific community and nursing practitioners through publications and handouts.

In addition, the new comprehensive approach may lead to the further development of digitization of mobility tracking, beyond previous methods such as accelerometry. Moreover, it was remarkable that the experts' recommendations for tools to assess nurses' knowledge and skills regarding residents' mobility consisted of solely qualitative instruments and descriptions. Hence, we recommend the development of valid quantitative assessment tools to identify the abovementioned contextual factors.

Furthermore, future mobility research and promotion might benefit from a comprehensive assessment tool, reflecting as many research fields and professions in relevant contextual factors as possible. Contrary to prevailing assessment tools, such a holistic instrument may reveal the underlying cause of (im)mobility rather than just indicating the presence or absence of mobility or a related parameter. Representing a holistic view on mobility, it might also lead to a common understanding of mobility across disciplines and, in turn, a common use of a uniform definition. While in theory, a holistic instrument might be the ideal solution, future research needs to approach the task by taking initial steps toward creating more extensive tools for assessing mobility in nursing home residents.

## Strengths and Limitations

This Delphi study reached agreement across disciplines and generated an updated comprehensive definition of mobility in nursing home residents.

The composition of the surveyed cohort regarding nationality and expertise highlights the representative nature of the present findings. Integrating experts from 15 different countries, the Delphi survey conducted in the study gathered international knowledge and views on mobility. The broad range of professions and expertise taken into account assured the wide diversity of collected opinions. We therefore consider the present study's cohort and corresponding results to be representative.

However, a few limitations need to be considered. Despite the representative nature of our cohort as stated above, we cannot assure that our cohort or responses are fully comprehensive. Missing but potentially relevant professions among the experts were, for example, architects and landscape planners who may be potentially involved in designing nursing home environments.

To include as many experts in relevant fields as possible, in the first round of the survey, we asked the participants to suggest further suitable experts.

Another limiting factor was the study language. In order to address international experts, the questionnaire language was English. However, because the study directors and a significant share of the cohort were German speaking, participants were also offered the option of responding in German. Hence, the effect of bias due to language barriers cannot be ruled out but is considered to be negligible.

As the understanding of mobility and assessment tools is tied to the nursing home residents' context, it presents a potential limitation of applicability and generalizability. Therefore, when applying or working with this definition and the associated contextual factors and assessment tools in other cohorts such as geriatric hospital patients, caution is merited.

Due to the rapid increase of digitalization and technical advances, one might expect related responses in this Delphi study (eg, virtual reality and messenger services as a means of nonphysical mobility and social interaction, as well as exoskeletons for supporting impaired individuals' physical movement). However, none of the experts mentioned such aspects. Nevertheless, we assume that they will have a high impact on mobility measures and interventions in the future.

The fact that human movement scientists constituted the majority of the cohort members could be due to the study directors' professions in related fields, leading to corresponding networks which were contacted for recruitment. Furthermore, a higher response rate of human movement scientists might have been caused by more frequent encounters with the survey topic than would be the case for other professions. Nevertheless, the similarity of ratings between groups of different professions indicates

interdisciplinary acceptance and support for the present results.

## Conclusion

To our knowledge, this is the first international consensus study providing a holistic definition of mobility for nursing home residents, including a comprehensive selection of relevant influencing measures and facets. The cluster of contextual factors and tools is based on an extensive evaluation of the literature and the opinion of international experts with various interdisciplinary perspectives. Thus, the majority of experts considered the contextual factors and the assessment tools for the development of interventions and the selection of evaluation instruments as applicable. The results offer the opportunity to define specific recommendations for preventive work and to enable nursing home staff to promote mobility in everyday care more comprehensively. Contrary to previous definitions of mobility, the updated definition provides a plurality of approaches for promoting mobility beyond residents' functional capacity on a physical level. Therefore, following this holistic mindset, a greater variety of factors causing immobility and measures promoting mobility might be addressed. However, a consensus study can only reflect the opinion of experts, and results should stimulate future discussion, scientific evaluation, and practical testing.

## Supplementary Material

Supplementary data are available at *Innovation in Aging* online.

## Funding

This study was funded by the Verband der Privaten Krankenversicherung e.V. and was part of the project PflBeO – Nursing Homes Movement Friendly Organizations. The funding body was not involved in designing, conducting, analyzing, or reporting the study and its results. The manuscript has not been peer-reviewed by the funding body.

## Conflict of Interest

None declared.

## Acknowledgments

The authors would like to thank all of the participants for their contributions, which provided the profound expertise on which the study results are based. Among them are Maayan Agmon, Bianca Berger, Thomas Cordes, Kim Delbaere, Jennifer Hewitt, Carl-Philipp Jansen, Thomas Klotzbier, Martina Roes, Julian Rudisch, Axel Schäfer, Nadja Schott, Ansgar Schwirtz, Dawn Skelton, Karen Sverdrup, Morag Taylor, Christian Thiel, Lutz Vogt, and Alexander Woll.

## References

1. England K, Azzopardi-Muscat N. Demographic trends and public health in Europe. *Eur J Public Health*. 2017;27(suppl\_4):9–13. doi:10.1093/eurpub/ckx159
2. Albert SM, Bear-Lehman J, Anderson SJ. Declines in mobility and changes in performance in the instrumental activities of daily living among mildly disabled community-dwelling older adults. *J Gerontol A Biol Sci Med Sci*. 2015;70(1):71–77. doi:10.1093/gerona/glu088
3. Lach HW. Home sweet home: resources for promoting mobility for aging in place across settings. *J Gerontol Nurs*. 2021;47(5):3–6. doi:10.3928/00989134-20210407-01
4. Shumway-Cook A, Ciol MA, Yorkston KM, Hoffman JM, Chan L. Mobility limitations in the Medicare population: prevalence and sociodemographic and clinical correlates. *J Am Geriatr Soc*. 2005;53(7):1217–1221. doi:10.1111/j.1532-5415.2005.53372.x
5. International Classification of Functioning, Disability and Health (ICF). <https://icd.who.int/dev11/l-icf/en#/http://id.who.int/icd/entity/2048203604>. Published April 25, 2022. Accessed April 25, 2022.
6. Jamour M, Becker C, Bachmann S, et al. Empfehlungen für die Durchführung des motorischen Assessments der unteren Extremität zur ICF-basierten Verlaufsbeurteilung der Mobilität in der stationären geriatrischen Rehabilitation: Bericht eines interdisziplinären Konsensusprozesses. *Z Gerontol Geriatr*. 2011;44(6):429–436. doi:10.1007/s00391-011-0267-1
7. Webber SC, Porter MM, Menec VH. Mobility in older adults: a comprehensive framework. *Gerontologist*. 2010;50(4):443–450. doi:10.1093/geront/gnq013
8. Cordes T, Bischoff LL, Schoene D, et al. A multicomponent exercise intervention to improve physical functioning, cognition and psychosocial well-being in elderly nursing home residents: a study protocol of a randomized controlled trial in the PROCARE (prevention and occupational health in long-term care) project. *BMC Geriatr*. 2019;19(1). doi:10.1186/s12877-019-1386-6
9. Schnitzer S, Blüher S, Teti A, et al. Risk profiles for care dependency: cross-sectional findings of a population-based cohort study in Germany. *J Aging Health*. 2020;32(5–6):352–360. doi:10.1177/0898264318822364
10. Karakaya MG, Bilgin SC, Ekici G, Köse N, Otman AS. Functional mobility, depressive symptoms, level of independence, and quality of life of the elderly living at home and in the nursing home. *J Am Med Dir Assoc*. 2009;10(9):662–666. doi:10.1016/j.jamda.2009.06.002
11. McGuigan FE, Bartosch P, Åkesson KE. Musculoskeletal health and frailty. *Best Prac Res Clin Rheumatol*. 2017;31(2):145–159. doi:10.1016/j.berh.2017.11.002
12. Silva NA de, Gregory MA, Venkateshan SS, Verschoor CP, Kuspinar A. Examining the association between life-space mobility and cognitive function in older adults: a systematic review. *J Aging Res*. 2019;2019:1–9. doi:10.1155/2019/3923574
13. Billot M, Calvani R, Urtamo A, et al. Preserving mobility in older adults with physical frailty and sarcopenia: opportunities, challenges, and recommendations for physical activity interventions. *Clin Interv Aging*. 2020;15:1675–1690. doi:10.2147/CIA.S253535
14. Nijs KAND, Graaf C de, Kok FJ, van Staveren WA. Effect of family style mealtimes on quality of life, physical performance, and body weight of nursing home residents: cluster randomised controlled trial. *BMJ*. 2006;332(7551):1180–1184. doi:10.1136/bmj.38825.401181.7C
15. Bourret EM, Bernick LG, Cott CA, Kontos PC. The meaning of mobility for residents and staff in long-term care facilities. *J Adv Nurs*. 2002;37(4):338–345. doi:10.1046/j.1365-2648.2002.02104.x
16. Zegelin A. ‘Tied down’—the process of becoming bedridden through gradual local confinement. *J Clin Nurs*. 2008;17(17):2294–2301. doi:10.1111/j.1365-2702.2007.02261.x
17. Schrank S, Zegelin A, Mayer H, Mayer H. Prävalenzerhebung zur Bettlägerigkeit und Ortsfixierung - Eine Pilotstudie. *Pflegewissenschaft*. 2013;13(4):230–238.
18. Trevelyan EG, Robinson N. Delphi methodology in health research: how to do it? *Eur J Integr Med*. 2015;7(4):423–428. doi:10.1016/j.eujim.2015.07.002
19. Skulmoski GJ, Hartman FT, Krahn J. The Delphi method for graduate research. *J Inf Technol Educ Res*. 2007;6(1):1–21. doi:10.28945/199
20. Keeney S. *The Delphi Technique in Nursing and Health Research*. Chichester, UK: Wiley-Blackwell; 2011.
21. Mayring P. Qualitative Inhaltsanalyse. In: Mey G, Mruck K, eds. *Handbuch Qualitative Forschung in der Psychologie*. Wiesbaden, Germany: VS Verlag für Sozialwissenschaften; 2010:601–613.
22. Podsiadlo D, Richardson S, Richardson S. The timed “Up & Go”: a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc*. 1991;39(2):142–148. doi:10.1111/j.1532-5415.1991.tb01616.x
23. Fried LP, Tangen CM, Walston J, et al.; Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*. 2001;56(3):M146–M156. doi:10.1093/gerona/56.3.m146
24. Durand VM, Crimmins DB. Identifying the variables maintaining self-injurious behavior. *J Autism Dev Disord*. 1988;18(1):99–117. doi:10.1007/BF02211821
25. Russell D. UCLA Loneliness Scale (version 3): reliability, validity, and factor structure. *J Pers Assess*. 1996;66(1):20–40. doi:10.1207/s15327752jpa6601\_2
26. Yamada K, Yamaguchi S, Ito YM, Ohe T. Factors associated with mobility decrease leading to disability: a cross-sectional nationwide study in Japan, with results from 8681 adults aged 20–89 years. *BMC Geriatr*. 2021;21(1):651. doi:10.1186/s12877-021-02600-4
27. Hobert MA, Jamour M. Assessment von Mobilität – geriatrisches Assessment zur Erfassung lokomotorischer Mobilitätseinschränkungen und Perspektiven der Instrumentierung [Assessment of mobility-Geriatric assessment instruments for mobility impairments and perspectives of instrumentation]. *Z Gerontol Geriatr*. 2022;55(2):116–122. doi:10.1007/s00391-022-02040-8
28. Saajanaho M, Rantakokko M, Portegijs E, et al. Personal goals and changes in life-space mobility among older people. *Prev Med*. 2015;81:163–167. doi:10.1016/j.ypmed.2015.08.015
29. Soubra R, Chkeir A, Novella JL. A systematic review of thirty-one assessment tests to evaluate mobility in older adults. *Biomed Res Int*. 2019;2019:1354362. doi:10.1155/2019/1354362

30. Ntanasi E, Yannakoulia M, Mourtzi N, et al. Prevalence and risk factors of frailty in a community-dwelling population: the HELIAD study. *J Aging Health*. 2020;32(1):14–24. doi:10.1177/0898264318801735
31. Turusheva AV, Frolova EV, Bogdanova TA. The prevalence of frailty, measured with different diagnostic tools, and autonomy decline: results of the Crystal study. *Rossiiskii semeinyi vrach*. 2021;25(1):35–43. doi:10.17816/RFD61632
32. Hilgenkamp TIM, van Wijck R, Evenhuis HM. Physical fitness in older people with ID—concept and measuring instruments: a review. *Res Dev Disabil*. 2010;31(5):1027–1038. doi:10.1016/j.ridd.2010.04.012
33. Kim MJ, Park S, Jung YI, Kim SH, Oh IH. Exploring health-related quality of life and frailty in older adults based on the Korean Frailty and Aging Cohort Study. *Qual Life Res*. 2020;29(11):2911–2919. doi:10.1007/s11136-020-02568-5
34. Takashi N, McCarthy MJ, Suzuki R, et al. Association of patient quality of life with the degree of agreement in the perceptions of patient disability within the stroke patient-rehabilitation therapist dyad: a cross-sectional study in postdischarge rehabilitation setting. *BMJ Open*. 2021;11(5):e043824. doi:10.1136/bmjopen-2020-043824
35. Arévalo SP, Kress J, Rodriguez FS. Validity of cognitive assessment tools for older adult Hispanics: a systematic review. *J Am Geriatr Soc*. 2020;68(4):882–888. doi:10.1111/jgs.16300
36. Huo Z, Lin J, Bat BKK, et al. Diagnostic accuracy of dementia screening tools in the Chinese population: a systematic review and meta-analysis of 167 diagnostic studies. *Age Ageing*. 2021;50(4):1093–1101. doi:10.1093/ageing/afab005
37. Delbroek T, Vermeylen W, Spildooren J. The effect of cognitive-motor dual task training with the biorescue force platform on cognition, balance and dual task performance in institutionalized older adults: a randomized controlled trial. *J Phys Ther Sci*. 2017;29(7):1137–1143. doi:10.1589/jpts.29.1137
38. Burks HB, Des Bordes JKA, Chadha R, Holmes HM, Rianon NJ. Quality of life assessment in older adults with dementia: a systematic review. *Dement Geriatr Cogn Disord*. 2021;50(2):103–110. doi:10.1159/000515317
39. Santana-Berlanga NR, Porcel-Gálvez AM, Botello-Hermosa A, Barrientos-Trigo S. Instruments to measure quality of life in institutionalised older adults: systematic review. *Geriatr Nurs*. 2020;41(4):445–462. doi:10.1016/j.gerinurse.2020.01.018
40. Mast BT, Molony SL, Nicholson N, Kate Keefe C, DiGasbarro D. Person-centered assessment of people living with dementia: review of existing measures. *Alzheimers Dement (NY)*. 2021;7(1). doi:10.1002/trc2.12138
41. Bélanger E, Thomas KS, Jones RN, Epstein-Lubow G, Mor V. Measurement validity of the Patient-Health Questionnaire-9 in US nursing home residents. *Int J Geriatr Psychiatry*. 2019;34(5):700–708. doi:10.1002/gps.5074
42. Benedetti A, Wu Y, Levis B, et al. Diagnostic accuracy of the Geriatric Depression Scale-30, Geriatric Depression Scale-15, Geriatric Depression Scale-5 and Geriatric Depression Scale-4 for detecting major depression: protocol for a systematic review and individual participant data meta-analysis. *BMJ Open*. 2018;8(12):e026598. doi:10.1136/bmjopen-2018-026598
43. Karim J, Weisz R, Bibi Z, ur Rehman S. Validation of the eight-item Center for Epidemiologic Studies Depression Scale (CES-D) among older adults. *Curr Psychol*. 2015;34(4):681–692. doi:10.1007/s12144-014-9281-y
44. Choi HK, Lee SH. Trends and effectiveness of ICT interventions for the elderly to reduce loneliness: a systematic review. *Healthcare (Basel)*. 2021;9(3). doi:10.3390/healthcare9030293
45. Isik EI, Inel Manav A, Bozdogan Yesilot S. An evaluation of successful aging levels of nursing home residents. *RASP*. 2021;9(1):51–78. doi:10.17583/rasp.2020.5240
46. Egeljić-Mihailović N, Brkić-Jovanović N, Krstić T, Simin D, Milutinović D. Social participation and depressive symptoms among older adults during the Covid-19 pandemic in Serbia: a cross-sectional study. *Geriatr Nurs*. 2022;44:8–14. doi:10.1016/j.gerinurse.2021.12.014
47. Fahsold A, Schmüdderich K, Verbeek H, Holle B, Palm R. Feasibility, interrater reliability and internal consistency of the German Environmental Audit Tool (G-EAT). *Int J Environ Res Public Health*. 2022;19(3):1050. doi:10.3390/ijerph19031050
48. Norin L, Iwarsson S, Haak M, Slaug B. The Housing Enabler instrument: assessing threats to reliability and validity. *Br J Occup Ther*. 2019;82(1):48–59. doi:10.1177/0308022618782329
49. Sverdrup K, Bergh S, Selbæk G, et al. Trajectories of physical performance in nursing home residents with dementia. *Aging Clin Exp Res*. 2020;32(12):2603–2610. doi:10.1007/s40520-020-01499-y
50. Quan NG, Lohman MC, Resciniti NV, Friedman DB. A systematic review of interventions for loneliness among older adults living in long-term care facilities. *Aging Ment Health*. 2020;24(12):1945–1955. doi:10.1080/13607863.2019.1673311
51. Tavares-Júnior JWL, de Souza ACC, Alves GS, et al. Cognitive assessment tools for screening older adults with low levels of education: a critical review. *Front Psychiatry*. 2019;10:878. doi:10.3389/fpsy.2019.00878
52. Nordbakke S, Schwanen T. Well-being and mobility: a theoretical framework and literature review focusing on older people. *Mobilities*. 2014;9(1):104–129. doi:10.1080/17450101.2013.784542
53. Pfeifer K, Sudeck G, Brüggemann S, Huber G; DGRW-Update. Bewegungstherapie in der medizinischen Rehabilitation – Wirkungen, Qualität, Perspektiven. *Rehabilitation*. 2010;49(04):224–236. doi:10.1055/s-0030-1261909