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Laying the foundation for an ICF core set for community-dwelling elderly adults in primary care: the research perspective identified by a review of the literature

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Laying the foundation for an ICF core set for community-dwelling elderly adults in primary care: the research perspective identified by a review of the literature

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Abstract

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Objectives: Overmedicalization grows with ageing. Concentrating on functioning might help to discriminate between necessary and unnecessary medicine. The International Classification of Functioning, Disability and Health (ICF) is a tool for describing functioning. Being too detailed, the aim is to develop a Core Set for geriatric patients in primary care. The objective of this study was to find relevant concepts of functioning within the scientific literature.

Design: A systematic literature review was conducted. Articles dealing with functioning in the elderly were searched and assessed for eligibility. Relevant concepts were extracted and linked to the ICF following established linking rules. Finally, a frequency analysis was conducted.

Setting: Home, primary care.

Participants: Community-dwelling adults aged 75 and older.

Results: From 5,060 identified publications 82 were included. Overall 1,182 concepts were retrieved. Most were linked to the 'activities and participation' component. The most frequently identified categories were *'memory functions', 'dressing',* and *'changing basic body position'.*

Conclusions: This review provides a list of relevant ICF categories from the research perspective that will be used for developing the ICF Core Set for older primary care patients.

Trial registration number: The study is registered in PROSPERO (CRD42017067784), *Versorgungsforschung Deutschland Datenbank* [VfD_17_003833] and clinicaltrials.gov [NCT03384732].

Keywords: International Classification of Functioning, Disability and Health, community-dwelling older persons, geriatric health services, general practice

1 Article Summary

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1.1 Strengths and limitations

- A broad literature search was performed in five key medical and social databases.
- This review encompasses a broad spectrum of studies, going beyond the conventional randomized controlled trials and clinical trials and including observational and qualitative studies.
- The researchers involved in this study are from different disciplines, allowing for an interdisciplinary perspective on the topic.
- Restricting the search to articles published in English or German in specific high-resources countries and drawing a random sample for full text screening carries the risk of losing potentially relevant publications.
- Excluding studies that focus solely on body structures may have introduced some bias in the results.

2 Introduction

The ever increasing life expectancy is accompanied by an increasing prevalence of chronic diseases(1, 2). Thus, older patients are often affected by multimorbidity and as a consequence also polypharmacy, which is defined as the concurrent use of multiple medicines(3, 4). Inappropriate polypharmacy, especially in old age, can lead to negative outcomes such as adverse drug events, increased risk for fractures, hospitalization, and even death(5, 6). Considering these negative outcomes, the question arises if it is reasonable to initiate a certain treatment to prevent a patient from having one disease even when this treatment may increase the patient's risk of dying from another disease. In 1986, Jamoulle initially proposed the concept of quaternary prevention(7), which is defined as an "action taken to identify patient at risk of overmedicalization, to protect him from new medical invasion, and to suggest him interventions ethically acceptable"(8). Providing too much medicine is both an ethical and an economical problem(9). Moreover, the phenomenon called "disease mongering", i.e. the commercialization of disease, which turns healthy people into patients, is increasingly becoming a problem(10, 11). In addressing these issues, general practitioners play a crucial

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role. In Germany they are the primary contact for the ambulatory care of older patients. There is some evidence that with increasing age the potential of chronic conditions to predict mortality decreases, while functioning limitations seem to become stronger predictors(12). Functioning limitations are not only a predictor of mortality, but also provide important information about the severity and consequences of chronic conditions(13). Thus, functioning information together with disease information might be a better indicator of necessary and unnecessary medicine in older persons than disease information alone. The term *functioning* can be defined as a person's intrinsic health capacity, as well as what the person actually does or is not able to do in everyday life in light of the interaction between this health capacity and environmental factors(14-16). Functioning can be described using the International Classification of Functioning, Disability and Health (ICF). Launched by World Health Organization (WHO) in 2001, the ICF is an internationally recognized reference framework for health and health-related states from a bio-psycho-social perspective(17). Functioning can be documented with ICF domains and categories that are structured hierarchically at different levels within the components of 'body functions' (b), 'body structures' (s), 'activities and participation' (d), 'environmental factors' (e) and 'personal factors' (not classified) using an alphanumeric coding system. With more than 1,400 categories, the ICF is, however, too extensive to be used in daily practice. To address this issue, shorter lists of categories, so-called ICF Core Sets (ICF-CS), have been developed for several health conditions.[1] These ICF-CSs comprise categories that cover the typical spectrum of functioning aspects relevant to persons living with the given condition(18). ICF-CS for primary care and for geriatric patients have already been developed(19-21). However, none of these were developed according to the standardized process for developing ICF-CS(18). For this reason, we aimed to develop an ICF-CS, covering the life and functioning of geriatric patients aged 75 years and older in primary care, following the standardized process. This process includes a preparatory phase followed by an international ICF consensus conference and the implementation of the first version of the ICF-CS. During the preparatory phase, four studies are conducted to identify relevant ICF categories from four different perspectives: a systematic literature review (research

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perspective), a qualitative study (perspective of the target population)(22), an expert survey (experts' perspective), and an empirical study (clinical perspective)(23). It is important to capture these different perspectives in the development process in order to gain a holistic understanding of the functioning of people living with a specific health condition.

In this paper, the methods and the results of the systematic literature review of the project to develop ICF-CS for older persons in primary care are presented. The aims were (a) to identify concepts contained in instruments for assessing functioning of older persons (≥75 years) that are frequently used in published studies and (b) to link these concepts to the ICF.

3 Methods

This systematic literature review was conducted following the methodology proposed by the ICF Research Branch(18).[2] This methodology is composed of five steps: 1) literature search, 2) study selection, 3) extraction of relevant concepts, 4) linkage of the concepts to the ICF and 5) frequency analysis. In contrast to other systematic reviews, we did not aim to answer clinical questions by reviewing existing evidence, but to systematically extract the concepts used by the scientific community to operationalize functioning. A study protocol has recently been published elsewhere(24). This review was registered in PROSPERO (CRD42017067784) on 07/10/2017 and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines(25).

3.1 Eligibility Criteria

The selection of the eligibility criteria was guided by the PICOS (Population, Intervention, Comparison, Outcomes, Study design) framework(26). Due to the special focus of this review, only the 'P', 'O', and 'S' were relevant for our search.

Population: For a publication to be included in this review, all the participants included in the published study had to be community-dwelling and at least 75 years old. Studies that included institutionalized participants (e.g. nursing home), participants recruited in a hospital or rehabilitation center, or participants with dementia were excluded. As the intended ICF-CS is meant to be used in primary care practices in Germany, only studies conducted in high-

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resource countries with a similar socio-economic and cultural background were considered. Consequently, only studies conducted in the member states of the European Union and the European Free Trade Association, the United States, Australia and New Zealand were included. Moreover, to get a representative picture of the health reality of old adults, studies with participants suffering from only one specific health condition were excluded.

Outcomes: The publications had to be related to functioning as defined by the ICF (e.g. activities of daily living, social interaction, physical mobility). Publications reporting on studies that solely focused on body structures without considering any other features of functioning were excluded to ensure that the resulting candidate categories reflect the integrative biopsychosocial nature of functioning.

Study design: As suggested in the ICF-CS development guidelines, randomized controlled trials, clinical controlled trials, cross-sectional studies, observational studies and qualitative studies were included(18). Study protocols, case studies, economic evaluation studies, conference papers, psychometric studies, prevention studies, studies of phase-II clinical trials, studies exclusively showing laboratory parameters, animal experiments, letters, comments and editorials were excluded, as those publications usually do not include relevant information on functioning(18). Furthermore, systematic reviews and meta-analyses were not included in this review.

3.2 Literature search

Electronic searches were carried out in PubMed, PsycINFO, EMBASE, CINAHL und Scopus to identify potentially relevant publications. The search terms were organized into population (e.g. aged, elderly, older adults), living condition (e.g. community-dwelling, independently living) and outcome variables according to the ICF-related terms (e.g. social life, self-care, home environment) using the thesaurus of the respective database (e.g. Medical subject headings in PubMed) as well as free text words. Only studies published between 2007 and 2017 in peer-reviewed journals in English or German were considered for inclusion. The search strategy was reviewed by an experienced librarian. The whole search strategy is available at PROSPERO(27).

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3.3 Study selection

The publications found in the databases were exported to a review manager (Covidence). After having removed duplicates, five researchers (JT/SH/SG/SB/EF) performed a title and abstract screening based on the predefined eligibility criteria. Title and abstract of each publication were screened by two researchers independently. As an overwhelming number of publications were identified for the full text screening, a random sample was drawn to ensure manageability. As the purpose of this review was not to answer clinical questions by evaluating existing evidence, but only to systematically identify relevant concepts of functioning, drawing a random sample was possible. This procedure has already been applied in previous ICF-CS development projects(28-31) and is also recommended in the guidelines(18). It was decided that a random sample, containing 50% of all publications, should be included for full text screening. The random sample was drawn using the Random Integer Set Generator(32). The full texts were screened pairwise by four independent researchers (JT/SH/SG/SB) based on the predefined inclusion and exclusion criteria. Results were compared and any disagreement was solved in discussion with all four researchers.

3.4 Assessment of study quality

As the purpose of this review was not to assess the effectiveness of certain interventions, but only to systematically identify relevant concepts of functioning, a quality assessment of the studies was considered unnecessary. Nevertheless, only studies that were published in peer-reviewed scientific journals were included for analysis. Thus, the publications have assumingly undergone a level of quality control.

3.5 Data extraction

Following the PICOS scheme, the following data were extracted from the publications:

- Population: age, gender, sample size, type of sample
- Intervention (if applicable)
- Control (if applicable)
- Outcomes: concepts identified in the article text; instruments for assessing functioning

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- Study design

Other data extracted were author, title, year and country. “A concept was defined as a single health aspect or a personal (internal) or environmental (external) factor with an impact on health. Formally, a concept could consist of a single word or a set of words”(33). Examples for concepts are living arrangements, social embeddedness or walking. Assessment instruments were defined as any kind of standardized outcome measure (e.g. questionnaires, clinical tests) used in the study. The extraction process led to two different data sets: 1) assessment instruments and 2) concepts extracted from the article text. The first data set is more objective as the assessment instruments provide a standardized and systematic basis for further analysis, whereas the second data set is more subjective. Because of this and based on the methodology applied in other ICF-CS development projects, it was decided to focus only on the first data set(34-37). Disagreement between the two researchers regarding the extracted data was solved by discussion. When consensus between the two could not be reached, a third researcher was consulted.

3.6 Data synthesis

Assessment instruments that were not available in the respective publication were accessed either through the internet or by contacting the authors of the included publications. Following the method of other ICF-CS development projects, only assessment instruments used in at least two different studies were considered(38, 39). The items and response options of each assessment instrument were listed on one table. Subsequently, meaningful concepts contained within each item or response option were extracted. The concepts were linked to ICF categories by two independent researchers using established linking rules(40). When consensus between the two researchers was not reached, a third researcher was consulted. If an ICF category was assigned repeatedly in an assessment instrument, it was counted only once. However, when a publication reported on a study that used multiple instruments and a specific category was identified in more than one of these instruments, this particular category was counted according to the number of instruments to which it was linked. Therefore, the

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maximum count of one category can exceed the number of identified studies included in the review. We used descriptive statistics to report the most frequently identified ICF categories. Only first-level and second-level ICF categories are reported in this paper.[3] If a concept was linked to a third- or fourth-level ICF category, the overarching second-level category was included for analysis. Due to the hierarchical nature of the ICF, a lower-level category shares the attributes of the higher-level category of which it is a member(17).

3.7 Patient and public involvement

Patients and the public were not involved in this study.

4 Results

4.1 Study Selection

A total of 10,043 publications were identified. After removing duplicates, 5,060 potentially relevant publications were left. In the abstract screening 681 articles were identified for full-text screening. Of these, a random sample of 341 articles (50%) was drawn for the full text screening, from which 82 articles were subsequently included for data extraction (see figure 1). The references of the included studies are available in Appendix A, the study characteristics in Appendix B.

Please insert figure 1 here

4.2 Study characteristics

The 82 publications included studies that were conducted in 17 different countries. About 20% of the studies were conducted in Finland (n = 16), 14.6% in Sweden (n = 12) and 12.2% in the United States (n = 10). The investigated study population consisted of 74,351 community-dwelling elderly, of whom 68.6% were female. Three publications did not provide information about the gender of their participants. Most of the studies (65.9%) had an observational design (longitudinal or cross sectional), 15.6% were qualitative studies, 12.2% intervention studies, 4.9% analyzed secondary data and one study (1.2%) used mixed methods.

4.3 Linking Results

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From the 82 included publications 111 assessment instruments were identified. Out of these, 30 were identified in at least two of the publications and were included for data extraction (table 1).

Table 1

Frequency of use and thematic focus of the included assessment instruments.

Assessment instrument	Nr. of studies	Cognition	Mobility	Functioning	Environmental status	factors	Health conditions
Mini Mental State Examination (MMSE)	24	x					
Lawton Instrumental Activities of Daily Living Scale	15			x			
Katz Index of Independence in Activities of Daily Living	14			x			
Geriatric Depression Scale - 15 items	11						x
Short Physical Performance Battery	7		x				
Activities of Daily Living staircase	7			x			
Timed up and go	6		x				
Short Form Health 36	6			x			
Geriatric Depression Scale - 30 items	5						x
Barthel Index of Activities of Daily Living	4			x			
The University of Alabama at Birmingham Study of Aging Life-Space Assessment	4					x	
Berg Balance Scale	4		x				
Center for Epidemiologic Studies Depression Scale	4						x
EuroQoL-5 dimension	3			x			
Groningen Activity Restrictions Scale	3			x			
Abbreviated Mental Test Score	3	x					
Minimum Data Set - Home Care	3	x	x	x		x	x

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Mobility-Tiredness-Scale	3					
Perceived environmental barriers to outdoor mobility	2				x	
Cognitive Performance Scale	2	x				
Functional Independence Measure	2		x	x		x
Gait Speed	2		x			
Gijón Social Scale	2				x	
Housing Enabler Screening Tool	2				x	
Housing Options for Older People	2				x	
Impact on Participation and Autonomy Questionnaire	2		x	x	x	
Instrumental Activity Measure	2			x		
Mini Nutritional Assessment	2		x	x		x
Neuropsychological Aging Inventory	2			x	x	
Usability in my Home Questionnaire	2				x	

The most frequently used assessment instrument was the Mini Mental State Examination (MMSE), which was reported in 24 articles (29.3%). From the selected assessment instruments 1,182 concepts were extracted. Out of these, 24 concepts were linked to first-level ICF categories, 1,066 to second-level categories and 48 multidimensional concepts to two or more ICF categories. Forty-four concepts could not be assigned to a specific ICF category.

The 1,066 concepts were assigned to 87 different second-level ICF categories (see table 2). Of these, 41 (47.1%) are related to ‘activities and participation’, 24 (27.6%) categories refer to ‘body functions’, 20 (23.0%) to ‘environmental factors’ and two (2.3%) belong to ‘body structures’. Mentioned 53 times, the category *memory functions (b144)* was the most frequently identified category. Within the ‘activities and participation’ component, the category *dressing (d540)* and within the ‘environmental factors’ component, *products or substances for personal consumption (e110)* were identified most often. The two extracted ICF categories for

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'body structures' were *structure of upper extremity (s730)* and *structure of lower extremity (s750).* All 87 ICF categories will serve as candidates for considering during the consensus conference to decide on the ICF-CS for older persons in primary care.

Table 2

Frequency of second-level ICF categories linked to concepts identified in the assessment instruments.

ICF code	ICF category	Count
Activities and participation		
d177	Making decisions	9
d166	Reading	2
d170	Writing	2
d210	Undertaking a single task	28
d230	Carrying out daily routine	9
d240	Handling stress and other psychological demands	7
d360	Using communication devices and techniques	17
d410	Changing basic body position	39
d450	Walking	36
d470	Using transportation	25
d455	Moving around	24
d460	Moving around in different locations	21
d475	Driving	17
d420	Transferring oneself	15
d430	Lifting and carrying objects	8
d445	Hand and arm use	5
d415	Maintaining a body position	3
d465	Moving around using equipment	2
d540	Dressing	41
d510	Washing oneself	39
d550	Eating	36
d530	Toileting	30
d520	Caring for body parts	13
d560	Drinking	11
d570	Looking after one's health	5
d640	Doing housework	37

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d630	Preparing meals	28
d620	Acquisition of goods and service	28
d650	Caring for household objects	6
d660	Assisting others	2
d750	Informal social relationships	4
d710	Basic interpersonal interactions	2
d720	Complex interpersonal interactions	2
d760	Family relationships	2
d770	Intimate relationships	2
d870	Economic self-sufficiency	17
d850	Remunerative employment	7
d860	Basic economic transactions	2
d920	Recreation and leisure	19
d910	Community life	5
d930	Religion and spirituality	5
Body functions		
b144	Memory functions	53
b114	Orientation functions	35
b140	Attention functions	35
b152	Emotional functions	35
b167	Mental functions of language	30
b130	Energy and drive functions	28
b126	Temperament and personality functions	23
b110	Consciousness functions	5
b134	Sleep functions	5
b160	Thought functions	5
b147	Psychomotor functions	3
b172	Calculation functions	3
b280	Sensation of pain	12
b210	Seeing functions	3
b230	Hearing functions	3
b330	Fluency and rhythm of speech functions	5
b525	Defecation functions	19
b510	Ingestion functions	3

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b530	Weight maintenance functions	3
b620	Urination functions	25
b755	Involuntary movement reaction functions	13
b730	Muscle power functions	7
b810	Protective functions of the skin	3
b820	Repair functions of the skin	3
Body structures		
s750	Structure of lower extremity	2
s730	Structure of upper extremity	2
Environmental factors		
e110	Products or substances for personal consumption	17
e155	Design, construction and building products and technology of buildings for private use	12
e115	Products and technology for personal use in daily living	5
e120	Products and technology for personal indoor and outdoor mobility and transportation	4
e125	Products and technology for communication	2
e160	Products and technology of land development	2
e165	Assets	2
e210	Physical geography	2
e225	Climate	2
e240	Light	2
e250	Sound	2
e310	Immediate family	5
e315	Extended family	5
e320	Friends	5
e325	Acquaintances, peers colleagues, neighbors and community members	5
e355	Health professionals	3
e575	General social support services, systems and policies	5
e580	Health services, systems and policies	5
e530	Utilities services, systems and policies	4
e520	Open space planning services, systems and policies	2
e530	Utilities services, systems and policies	4
e520	Open space planning services, systems and policies	2

Note. d: activities and participation, b: body functions, s: body structures, e: environmental factors

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The assigned first-level categories can be seen in table 3. Forty-eight extracted concepts were not linkable to only one ICF category. For these concepts, two or more categories were chosen for each concept (table 4).

Table 3

Frequency of first-level ICF categories linked to concepts identified in the assessment instruments.

ICF Codes	ICF category	Count
e3	Support and relationships	9
d7	Interpersonal interactions and relationships	5
d3	Communication	2
d4	Mobility	2
d5	Self-care	2
d6	Domestic life	2
d8	Major life areas	2

Note. e: environmental factors, d: activities & participation

Table 4

Frequency of combinations of ICF categories linked to concepts identified in the assessment instruments.

ICF codes	Description	Count
b152, b1266	Feeling worthless	18
b130, b1264	Openness for new experiences	18
b1470, d720, b1521	Changes in behavior symptoms	3
b152, b130	Indicators of depression, anxiety, sad mood	3
b1641, d230, d177	Cognitive skills for daily decision-making	3
b755, b2402, b152	Fear of falling	3

Note. b: body functions, d: activities & participation

Out of the 44 concepts, which could not be assigned to a specific ICF category, 30 (68.2%) were characterized as ‘not definable’ (nd), implying that the concept belonged to the universe of the ICF, but a decision about the most precise ICF category could not be made(40). Nine (20.5%) concepts referred to ‘personal factors’ (pf) and five (11.4%) were ‘health conditions’ (coded as ‘not covered-health condition’, nc-hc). The ‘nd’ concepts mainly included general health, physical health, physical activity, and activities of daily living. Concepts linked to

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'personal factors' included living arrangements, self-sufficiency and medication adherence.[4] The commonly reported health conditions according to organ systems were diseases of the skin and subcutaneous tissue, psychiatric disorders, neurological diseases, infectious diseases, diseases of the digestive system, sensory disorders, diseases of the musculoskeletal system, and cancer.

5 Discussion

From the research perspective, the component 'activities and participation' has shown to be the most relevant among all ICF components with regard to functioning of older persons. Almost half of all assigned categories are in this component. ICF categories that belong to the components 'body functions' and 'environmental factors', were less frequently assigned. With only two ICF categories, 'body structures' seems to be the least relevant component of the four. However, this might be due to the fact that studies which solely focused on body structures without considering any other features of functioning were excluded. Such studies were excluded to ensure that the resulting candidate categories reflect the integrative biopsychosocial nature of functioning.

The ICF chapters with the most frequently assigned categories were: b1 'mental functions', d4 'mobility', d5 'self-care', and d6 'domestic life'. These areas are of special interest as they are prerequisites for being able to live independently at home. In a meta-analysis, indicators of functional and cognitive impairments were identified as the strongest predictors for necessitating admission to a nursing home(41). Cognitive impairment has also been identified as the strongest predictor for necessitating nursing home placement in a study investigating caregivers reasons for nursing home placement(42). Frequently identified categories referring to d5 'self-care' were *dressing (d540), washing oneself (d510), eating (d550),* and *toileting (d530)*. These are all activities of daily living. Literature indicates, that older adults with problems in three or more activities of daily living had a higher risk of being admitted to a nursing home than adults without problems(41). Household activities, like *doing housework (d640)* or *preparing meals (d630),* have frequently been identified in this review, but have not

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been found to be a major predictor for nursing home placement(41). This might be due to the fact that impairments in these areas can easily be compensated e.g. with household aids or assistance from family members.

No concepts were identified referring to the chapter b4 'functions of the cardiovascular, hematological, immunological and respiratory systems'. This might be due to the fact, that health conditions are coded with 'nc-hc' and not with the ICF category representing the underlying functions affected by a certain disease. Another explanation might be that, although the prevalence of diseases in these systems, especially of cardiovascular diseases, has increased since the 1980s, inability to perform activities of daily living as well as mortality induced by these diseases has decreased in the same period(2). This might be an explanation why recent research that focuses on functioning of the elderly, as reflected by the publications from 2007-2017, is less concerned with functions of the cardiovascular, hematological, immunological and respiratory systems. Moreover, no concepts were identified in the chapter e4 'attitudes'. As several studies and systematic reviews provide evidence that negative attitudes towards old age negatively affect the health of the elderly, attitudes might be a relevant aspect to be included in instruments assessing functioning(43-45).

Concepts referring to environmental factors with an impact on an individual's life were minimally addressed in the assessment instruments reported in the included articles. The most frequently identified category in this section was *products or substances for personal consumption (e110),* mainly assigned for the concept of medication. However, environmental factors like housing design (e.g. lighting conditions, uneven surfaces), neighborhood planning (e.g. public transportation, walkable community services), and social support (e.g. family, friends, or health professionals) play a crucial role in old age. Considering these environmental factors can contribute to the prevention of falls, nursing home placement as well as to the compensation of other negative effects of age-related declines(41, 46-48). Thus, developing instruments that addresses these essential environmental factors or revising current assessment instruments to include more environmental factors items may be warranted.

5.1 Strengths and limitations

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There are several strengths and limitations of this systematic literature review. A broad literature review was performed using a systematic search strategy in five key medical and social databases. One strength is its interdisciplinary nature. The researchers who developed the search strategy and conducted the study selection, data extraction and linking are from different disciplines (e.g. psychology, sports science, medicine), allowing for an interdisciplinary perspective on the topic. Furthermore, this review encompassed a broad spectrum of studies, going beyond the conventional randomized controlled trials and clinical trials and including observational and qualitative studies.

A limitation of this literature review is the restriction to articles published in English or German in specific high-resources countries. Thus, relevant studies that were conducted in other countries or published in other languages were possibly missed. Also drawing a random sample for full text screening carries the risk of losing potentially relevant publications. Finally, excluding studies that focus solely on body structures may have introduced some bias in the results. The reason for excluding these studies was mentioned above.

Some potentially relevant information may have been lost in the linking process, as the ICF is not precise enough to represent some relevant concepts for older adults. For example, fatigue, falls or fear of falling could not easily be linked to one specific ICF category. Sometimes more than one category was necessary to be able to describe these concepts; e.g. fear of falling was linked using *involuntary movement reaction functions (b755)*, *sensation of falling (b2402),* and *emotional functions (b152).* Other concepts could only be linked to the very general first-level ICF categories, not allowing a detailed representation of the concept; e.g. isolation was linked to s*upport and relationships (e3)*. Sometimes, the same concept could be linked to different categories. This was especially the case for concepts regarding the change of body positions. For example the concept “get into bed” can be linked to:

- *lying down (d4100);* defined as *“Getting into and out of a lying down position or changing body position from horizontal to any other position, such as standing up or sitting down”*(17) or to

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- *standing (d4104);* defined as *"Getting into and out of a standing position or changing body position from standing to any other position, such as lying down or sitting down"(17).*

This was one reason why we decided to link all concepts to second-level categories only. Being aware of these issues, WHO created a mechanism of updating ICF categories to further enhance the use of this classification(49). We will report the linking problems we faced to WHO after publication of this study.

5.2 Implications for practice

As mentioned above, functioning information together with disease information might be a better indicator of necessary and unnecessary medicine in older persons than disease information alone. This systematic literature review provides a list of relevant ICF categories from the research perspective that will be used, together with the results of the other three preparatory studies, for developing the ICF-CS for older primary care patients. In the long term, this ICF-CS is expected to support general practitioners in assessing functioning of their patients, defining treatment goals, and based on these goals, differentiating between necessary and unnecessary medical interventions.

6 Conclusions

In conclusion, this systematic literature review demonstrates that frequently used instruments for assessing functioning in older persons focus mainly on activities of daily living and mental functions, whereas environmental factors are only minimally addressed. Despite some limitations experienced in the linking process, the ICF provides a useful reference to identify and cluster the concepts used in instruments for assessing functioning of older adults.

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8 Footnotes

8.1 Contributors

JT was involved in the development of the search strategy; performed the literature search; took part in the screening of the papers, the data extraction and the linking process; performed the data analysis; was involved in the interpretation of the data; drafted parts of the manuscript and collated all sections from the co-authors. SHe was involved in the development of the search strategy, the screening of the papers, the data extraction, the linking process and the interpretation of the data. MS advised the research team on the ICF Core Set methodology and revised the draft. EF was involved in the conception of the study, the development of the search strategy and the abstract screening; provided supervision and revised the draft. EG/TK/SHu were involved in the conception of the study and in the development of the search strategy; provided supervision and revised the draft. SB/SG were involved in the development of the search strategy, the screening of the papers, the data extraction, the linking process and the interpretation of the data; drafted parts of the manuscript. All authors read and approved the final version of the manuscript. SB and SG contributed equally to this work.

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8.3 Disclaimer

The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

8.4 Competing interests

None declared.

8.5 Patient consent for publication

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Not required.

8.6 Ethics approval

Not required.

8.7 Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

8.8 Notes

[1] A list of accredited ICF-CS can be found here: https://www.icf-core-sets.org/en/page1.php. [2] The ICF Research Branch is a cooperation partner within the WHO collaborating center for the Family of International Classifications (WHO-FIC) in Germany, which aims to promote health by implementing ICF based tools and models(50).[3] The categories of the ICF are divided into different levels. First-level categories are coded using the component letter (b, s, d, or e) followed by the chapter number (one digit). Second-level categories are coded using the letter and three digits; the third- and fourth-level categories using the letter and four or five digits. [4] "Personal factors are contextual factors that relate to the individual such as age, gender, life experiences and so on" whereas environmental factors "refer to all aspects of the external or extrinsic world that form the context of an individual's life and, as such, have an impact on that person's functioning" such as human-made physical world, social systems or laws(17).

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10 List of abbreviations

ICF: International Classification of Functioning, Disability and Health

ICF-CS: International Classification of Functioning, Disability and Health core set

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PICOS: Patients, Intervention, Comparison, Outcomes, Study design

11 List of figures

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

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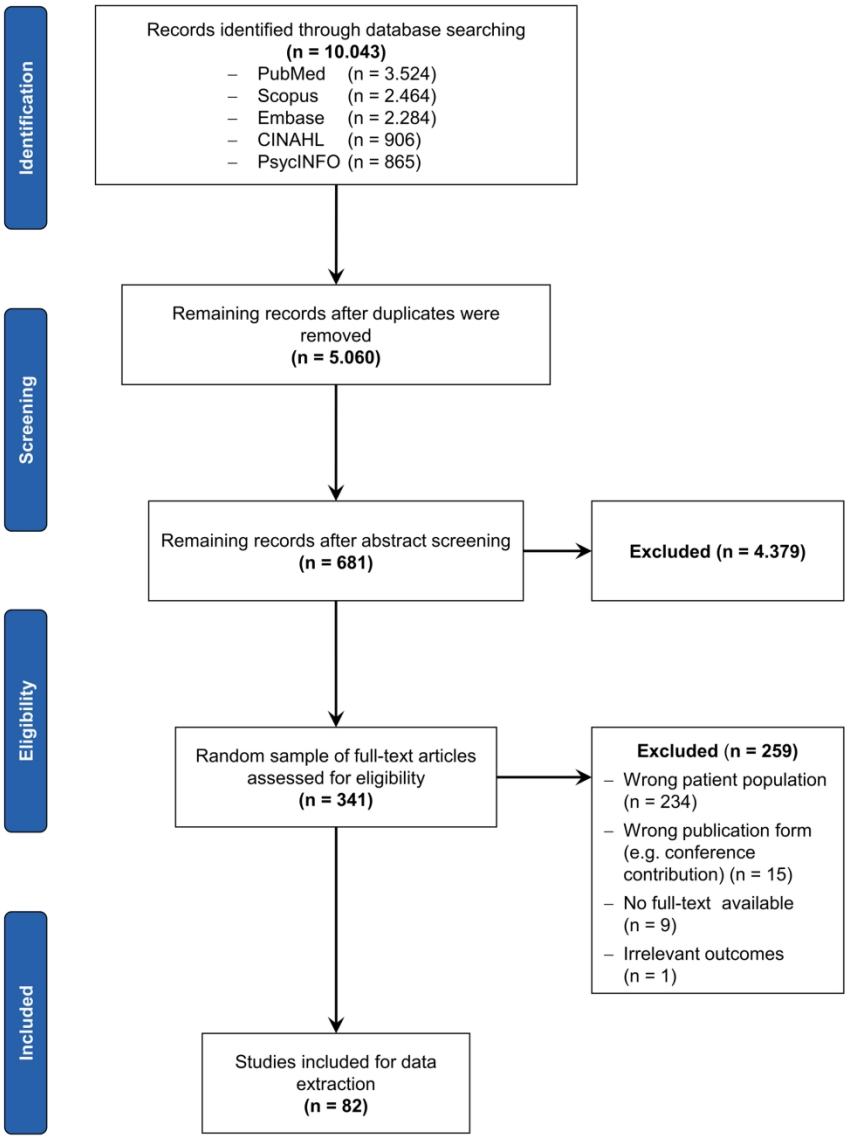

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

169x225mm (300 x 300 DPI)

Appendix A

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Appendix B

Characteristics of included studies

Study	Methods					Demographics		
	Country	Design	Type of intervention (if applicable)	Type of control (if applicable)	Sample size	Type of sample	Age	Female (%)
Aartolahti et al. (2013)	Finland	cross-sectional study	multidisciplinary intervention, focused on medication, nutrition, and exercise	n/a	576	community-dwelling	76-100	70.0
Abellan et al. (2013)	France	cross-sectional study	n/a	n/a	3,025	community-dwelling	≥75	100.0
Ahluwalia et al. (2010)	USA	qualitative study using interviews and grounded theory	n/a	n/a	23	community-dwelling	≥78	61.0
Almeida et al. (2015)	Australia	cross-sectional study	n/a	n/a	1,649	community-dwelling	80-93.7	0.0
Behm et al. (2015)	Sweden	RCT with follow-up after 1 and 2 years	preventive home visit group, senior meeting group	access to the ordinary range of services for older persons	459	community-dwelling	80-97	64.0
Berkemeyer et al. (2009)	Germany	cross-sectional study	n/a	n/a	440	community-dwelling	≥75	44.8
Blain et al. (2010)	France	longitudinal study	n/a	n/a	1300	community-dwelling	≥75	100.0
Bollwein et al. (2013)	Germany	cross-sectional	n/a	n/a	192	community-dwelling	75-96	64.6

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		study						
Brännström et al. (2013)	Sweden	qualitative study using narrative interviews and phenomenological hermeneutic method	n/a	n/a	7	community-dwelling	79-95	85.7
Brown et al. (2016)	USA	longitudinal cohort study	n/a	n/a	410	community-dwelling	≥75	57.0
Byles et al. (2015)	Australia	cross-sectional study	n/a	n/a	260	community-dwelling	75-80	50.4
Calvert et al. (2009)	USA	cross-sectional study	n/a	n/a	306	community-dwelling	≥85	62.0
Chipperfield et al. (2008)	Canada	prospective cohort study	n/a	n/a	198	community-dwelling	80-98	63.1
Dahlin-Ivanoff et al. (2007)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5
Diez-Ruiz et al. (2016)	Spain	prospective cohort study with 2 years follow-up	n/a	n/a	215	community dwelling	≥75	63.0
Eckerblad et al. (2015)	Sweden	qualitative study using semi-structured	n/a	n/a	20	community-dwelling	79-89	80.0

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		interviews and content analysis						
El-Khoury et al. (2015)	France	RCT	2-year exercise programme of progressive balance retraining in reducing injurious falls, weekly supervised group sessions supplemented by individually prescribed home exercises	brochures about fall prevention, newsletters, four free exercise sessions	706	community-dwelling	75-85	100.0
Eronen et al. (2016)	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0
Fabre et al. (2007)	USA	population-based cohort study	n/a	n/a	74	community-dwelling	≥90	51.3
Fänge et al. (2009)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5
Formiga et al. (2014)	Spain	longitudinal study	n/a	n/a	167	community-dwelling	≥85	60.5
Formiga et al. (2016)	Spain	RCT with 5-year follow-up	falls and malnutrition prevention	general primary care assessment	328	community-dwelling	≥85	61.6
Fritel et al. (2013)	France	observational cross-sectional study	n/a	n/a	1,942	community-dwelling	75-85	100.0
Gustafsson et al. (2013)	Sweden	RCT	preventive home visit group, senior meeting group	ordinary range of community services offered by the municipal care for the aged	459	community-dwelling	80-97	64.0

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Gustafsson et al. (2012)	Sweden	RCT	preventive home visit group, senior meeting group	access to the ordinary range of community services offered by the municipal agency	459	community-dwelling	80-97	64.0
Haak et al. (2007)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5
Ottenval Hammar et al. (2014)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	11	community-dwelling	84-95	54.5
Hegendörfer et al. (2017)	Belgium	prospective, observational, population based cohort study	n/a	n/a	501	community-dwelling	≥80	63.0
Heyl & Wahl (2010)	Germany	cross-sectional study	n/a	n/a	271	community-dweeling	75-94	54
Hoeksema et al. (2017)	Netherlands	cross-sectional study	n/a	n/a	1026	community-dwelling	≥75	59.0
Horgen et al. (2012)	Norway	mixed methods study	n/a	n/a	165	community-dwelling	75	n/a
Houston et al. (2011)	USA	secondary analysis of a longitudinal study with 3 years of	n/a	n/a	988	community-dwelling	77-100	64.5

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		follow-up						
Idland et al. (2013)	Norway	prospective , observational cohort study with 9 years follow-up	n/a	n/a	307 (baseline) 113 (follow-up)	community-dwelling	75-92	100.0
Iwarsson et al. (2009)	Sweden, Germany, Latvia	secondary analysis of a longitudinal survey study with 1 year follow-up	n/a	n/a	834	community-dwelling	75-89	79.7
Landi et al. (2010a)	Italy	secondary analysis of a prospective cohort study (baseline)	n/a	n/a	357	community-dwelling	≥80	67.0
Landi et al. (2010b)	Italy	secondary analysis of a prospective cohort study with 2 years follow-up	n/a	n/a	364 (baseline) 205 (follow-up)	community-dwelling	≥80	67.0
Larsson et al. (2009)	Sweden	qualitative study using interviews, observations and phenomenological method (Giorgi)	n/a	n/a	18	community-dwelling	86-93	55.6
Laudisio et al. (2013)	Italy	cross-sectional	n/a	n/a	356	community-dwelling	≥75	54.5

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		study						
Laudisio et al. (2015)	Italy	longitudinal, population-based study with 1-year follow-up	n/a	n/a	342	community-dwelling	≥75	56.0
Laudisio et al. (2010)	Italy	cross-sectional study	n/a	n/a	350	community-dwelling	≥75	54.3
Lofqvist et al. (2017)	Latvia	secondary analysis of a longitudinal study with 9 years follow-up	n/a	n/a	59	community-dwelling	77-90	90.0
Mahler & Sarvimäki (2012)	Denmark	qualitative study using narrative interviews and thematic analysis	n/a	n/a	5	community-dwelling	81-94	100.0
Mangani et al. (2008)	Italy	secondary analysis of a prospective cohort study	n/a	n/a	364	community-dwelling	≥80	67.0
Mänty et al. (2014)	Denmark, Finland	secondary analysis of a longitudinal study	n/a	n/a	561	community-dwelling	75	55.0
Mikkola et al. (2016)	Finland	secondary analysis of a cross sectional and	n/a	n/a	766	community-dwelling	75-90	62.7

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		longitudinal study						
Mikkola et al. (2015)	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0
Murabito et al. (2008)	USA	secondary analysis of a prospective cohort study	n/a	n/a	830	community-dwelling	79-88	61.4
Muscari et al. (2017)	Italy	prospective, longitudinal population-based study with 7 years follow-up	n/a	n/a	500	community-dwelling	85-102	65.8
Nitsch et al. (2011)	UK	cross-sectional study	n/a	n/a	2,967	community-dwelling	≥75	59.7
Nykänen et al. (2013)	Finland	population based randomized comparative study	n/a	n/a	696	community-dwelling	≥75	69.4
Polku et al. (2015)	Finland	prospective cohort study	n/a	n/a	848	community-dwelling	75-90	62.0
Portegijs et al. (2016)	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	753	community-dwelling	75-90	64.0

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Quail et al. (2007)	Canada	secondary analysis of a population-based cohort study	n/a	n/a	508	community-dwelling	75-96	66.9
Rantakokko et al. (2014)	Finland	secondary analysis of a cross-sectional study (baseline data)	n/a	n/a	847	community-dwelling	75-90	62.0
Rantakokko et al. (2016)	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	848 (baseline), 816 (1 year follow-up), 761 (2 years follow -up)	community-dwelling	75-90	62.0
Rantz et al. (2015)	USA	secondary analysis of a cross-sectional study	living with sensors	living without sensors	133	residents of independent living facility	mean age: 83	64.7
Rao et al. (2016)	Canada	secondary analysis of a cross-sectional study	n/a	n/a	1,668	community-dwelling	mean age: 82.9 (SD 6.9)	58.0
Rapo-Pylkko et al. (2016)	Finland	cross-sectional study	n/a	n/a	106	community-dwelling	75-85	74.0

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Rasinaho et al. (2006)	Finland	cross-sectional study	n/a	n/a	645	community-dwelling	75-81	74.3
Richards & Rankaduwa (2008)	Canada	cross-sectional study	n/a	n/a	722	community-dwelling	≥85	N/A
Rydwik et al. (2010)	Sweden	RCT 24 month follow-up	1) nutritional treatment (individual dietary counseling + 5 group sessions + general physical training advice) 2) physical training (regular physical group training of approx. 1h, twice a week for 12 weeks +general diet advice) 3) Training & nutrition (specific physical training & specific diet counseling/group session education)	general physical training advice & general diet advice	96	community-dwelling	≥75	60.4
Rydwik et al. (2008)	Sweden	RCT	1) nutrition (diet counseling/group session education + general physical training advice) 2) training (specific physical training + general diet advice) 3) Training & nutrition (specific physical training & specific diet counseling/group session education)	general physical training advice & general diet advice	96	community-dwelling	≥75	60.4
Sabayan et al. (2012)	Netherlands	population-based prospective follow-up study with cross-sectional and	n/a	n/a	572	community-dwelling	≥85	66.8

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		longitudinal analyses						
Sallinen et al. (2015)	Finland	qualitative study using thematic interviews and theory-driven content analysis	n/a	n/a	12	residents of service houses	80-92	75.0
Sampson et al. (2009)	UK	prospective cohort study	n/a	n/a	10,720	community-dwelling	≥75	59.6
Savikko et al. (2010)	Finland	cross-sectional study within an RCT	psychosocial group rehabilitation intervention	not named (participants were not considered for analysis)	117	community-dwelling and residents of independent living facility	75-92	74.0
Sixsmith et al. (2014)	Hungary, Latvia, United Kingdom, Germany, and Sweden	qualitative study using in-depth, semi-structured interviews and grounded theory	n/a	n/a	190	community-dwelling	75-89	61.6
Thompson et al. (2011)	USA	cross-sectional study	n/a	n/a	27	inhabitants of an independent retirement community	78-94	67.0
Tsai et al. (2015)	Finland	cross-sectional study	n/a	n/a	174	community-dwelling	75-90	64.0
Tsai et al.	Finland	cross-sectional	n/a	n/a	657	community-	75-81	75.0

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(2013)		study				dwelling		
van Bemmel et al. (2010)	Netherlands	prospective population-based study	n/a	n/a	277	community-dwelling	≥85	72.6
van Houwelingen et al. (2015)	Netherlands	cluster RCT	care plan for people with a combination of problems at the functional, somatic, mental, or social level	usual care	2,681 (baseline) 2,172 (follow-up)	community-dwelling	≥75	68.3
Vasara (2015)	Finland	qualitative study using semi-structured storylines and narrative analysis	n/a	n/a	14	community dwelling	78-88	64.3
Vestergaard et al. (2008)	Denmark	RCT	home-based video exercises; 26min/day; 3 times/week; 5 months; bi-weekly telephone call	bi-weekly telephone call	53	community-dwelling	75-91	100.0
von Humboldt & Leal (2015)	Portugal	qualitative study using interviews and qualitative content analysis	n/a	n/a	152	community-dwelling	75-102	61.2
Wang et al. (2017)	Australia	cross-sectional study	n/a	n/a	81	community-dwelling	mean age: 83.8 (SD 3.83)	44.4
Werth et al. (2017)	Australia	retrospective cross-sectional	n/a	n/a	239	community-dwelling	≥76	60.7

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		survey study						
Williams et al. (2007)	Australia	cross-sectional study	n/a	n/a	546	community-dwelling	75-96	68.0
Wilson et al. (2007)	UK	cross-sectional study	n/a	n/a	242	community-dwelling	80-90	69.9
Wong et al. (2010)	Canada	cross-sectional study	n/a	n/a	740	community-dwelling	75-96	68.0
Young (2009)	USA	prospective cohort study	n/a	n/a	298	people living in the independent living unit of a continuing care retirement community	75-94	69.1
Zingmond et al. (2011)	USA	retrospective cohort study	n/a	n/a	21,310	community-dwelling	≥75	78.0

Note. n/a = not applicable, N/A = not available

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Supplement
PRISMA Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	1-3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4-5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6-7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n/a
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7-8
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	n/a
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	8 (Fig. 1)

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Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Appendix B
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	n/a
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	n/a
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-18
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n/a
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	18-20
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	20-21
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	21
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	22

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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Laying the foundation for a Core Set of the International Classification of Functioning, Disability and Health (ICF) for community-dwelling elderly adults in primary care: Relevant categories of their functioning from the research perspective. A scoping review

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Secondary Subject Heading:	General practice / Family practice
Keywords:	GENERAL MEDICINE (see Internal Medicine), GERIATRIC MEDICINE, PRIMARY CARE

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Laying the foundation for a Core Set of the International Classification of Functioning, Disability and Health (ICF) for community-dwelling elderly adults in primary care: Relevant categories of their functioning from the research perspective. A scoping review

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Abstract

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Objectives: The objective of this study was to find relevant concepts of functioning in community-dwelling older adults within frequently used assessment instruments published in the scientific literature. This was part of a larger project to develop an International Classification of Functioning, Disability and Health (ICF) Core Set for use in primary care.

Design: A scoping review was conducted. Articles dealing with functioning in the elderly were searched and assessed for eligibility. The study population included community-dwelling older adults (≥ 75 years) without dementia, living in high-resources countries. Relevant concepts were extracted from assessment instruments and linked to the ICF. Finally, a frequency analysis was conducted.

Setting: Home, primary care.

Participants: Community-dwelling adults aged 75 years and above.

Results: From 5,060 identified publications 82 were included and 30 assessment instruments extracted. Overall, 1,182 concepts were retrieved. Most were linked to the 'activities and participation' component. The most frequently identified categories were *'memory functions',* *'dressing',* and *'changing basic body position'.*

Conclusions: This review provides a list of relevant ICF categories from the research perspective that will be used for developing an ICF Core Set for older primary care patients.

Trial registration number: PROSPERO (CRD42017067784), *Versorgungsforschung Deutschland Datenbank* [VfD_17_003833] and clinicaltrials.gov [NCT03384732].

Keywords: International Classification of Functioning, Disability and Health, community-dwelling older adults, geriatric health services, primary care

1 Article Summary

1.1 Strengths and limitations

- A broad literature search was performed in five key medical and social databases.

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- This review encompassed a broad spectrum of studies, including mainly cross-sectional and longitudinal studies as well as randomized controlled trials, but also two qualitative and one mixed method study.
- The researchers involved in this study were from different disciplines, allowing for an interdisciplinary perspective on the topic.
- Restricting the search to articles published in English or German in specific high-resources countries and drawing a random sample for full text screening carries the risk of losing potentially relevant publications.
- Excluding studies that focus solely on body structures may have introduced some bias in the results.

2 Introduction

The increasing average life expectancy is accompanied by an increasing prevalence of chronic diseases(1, 2). A blurring between the boundaries of diseases, risk factors and physiological aging processes can be observed(3, 4). In general practices in Germany the prevalence of multimorbidity in patients over the age of 60 is around 85%(5). Multimorbidity is a mostly disease-based concept, which is mainly being responded to pharmaceutically. The prevalence of polypharmacy in general practices in Germany is around 37%(5). Inappropriate polypharmacy can lead to adverse drug events, increased risk for fractures, hospitalization, or even death(6, 7) To address this issue of inappropriate polypharmacy, there is a need for new strategies (e. g. functioning information in the consultation) that consider the complexity of health in older adults. With increasing age, problems in functioning become a strong predictor of mortality and provide important information about the consequences of chronic conditions(8, 9). Making aware of these functioning problems might help shift the medical gaze towards problems and answers more rooted in the patients' lived experience of health, ultimately helping to better balance medical decisions. As general practitioners are the primary contact for community-dwelling patients, they could play an important role in advancing the paradigm change.

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Functioning can be defined as the product of the interaction between a person's intrinsic capacity and his/her environment. It can be described using the International Classification of Functioning, Disability and Health (ICF). With more than 1,400 categories, it is, however, too extensive to be used in daily practice. Thus, shorter lists of categories, so-called ICF Core Sets (ICF-CS), have been developed for several health conditions.[1] They comprise categories relevant to persons living with a specific condition(10). An ICF-CS for geriatric patients in early post-acute rehabilitation was developed in 2005(11). As target group and aims of rehabilitation can differ from that of general medicine, the categories included in this ICF-CS may likewise be different from an ICF-CS for geriatric patients in primary care. Two other ICF-CS, one for primary care and one for geriatric patients, have been developed in the Netherlands(12-14). Though they might turn out to be applicable to our study population, they were developed using methods other than the established multi-perspective methodology for developing ICF-CS, leaving out either the perspective of community-dwelling elderly or researchers. For this reason, we aimed to develop an ICF-CS for community-dwelling adults (≥ 75 years) for use in primary care, following the standardized process(10). This process includes a preparatory phase followed by a consensus conference. During the preparatory phase, four studies are conducted to identify relevant ICF categories: a systematic or scoping review (research perspective), a qualitative study (perspective of the target population)(15), an expert survey (experts' perspective), and an empirical study (clinical perspective)(16). To gain a comprehensive understanding of functioning, it is important to capture all four perspectives.

In this paper, methods and results of the scoping review are presented. The objective was to identify aspects of functioning in community-dwelling elderly adults considered relevant in frequently used assessment instruments published in the scientific literature.

3 Methods

This scoping review was conducted following the methodology proposed by the ICF Research Branch(10).[2] This methodology is composed of five steps: 1) literature search, 2) study selection, 3) extraction of relevant concepts, 4) linkage of the concepts to the ICF and 5)

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frequency analysis. We did not aim to answer clinical questions by reviewing existing evidence, but to systematically extract the concepts used by the scientific community to operationalize functioning related to community-dwelling older adults. A study protocol has been published elsewhere(17). This review was registered in PROSPERO (CRD42017067784) on 07/10/2017 and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) guideline(18).

3.1 Eligibility Criteria

The selection of the eligibility criteria was guided by the PICOS (Population, Intervention, Comparison, Outcomes, Study design) framework(19). Due to the special focus of this review, only the 'P', 'O', and 'S' were relevant for our search.

Population: For a publication to be included in this review, all the participants included in the published study had to be community-dwelling and at least 75 years old. Studies that included institutionalized participants (e.g. nursing home), participants recruited in a hospital or rehabilitation center, or participants with dementia were excluded. As the intended ICF-CS is meant to be used in primary care practices in Germany, only studies conducted in high-resources countries with a similar socio-economic and cultural background were considered. Consequently, only studies conducted in the member states of the European Union and the European Free Trade Association, the United States, Australia and New Zealand were included. Moreover, to get a representative picture of the health reality of old adults, studies with participants suffering from only one specific health condition were excluded, as they might have very specific needs.

Outcomes: The publications had to be related to functioning as defined by the ICF (e.g. activities of daily living, social interaction, physical mobility). Publications reporting on studies that solely focused on body structures without considering any other features of functioning were excluded. Since physicians tend to focus on physical aspects of health anyway, and the final ICF-CS is meant to complement this traditional emphasis on physical structures and processes with few categories as necessary (for reasons of feasibility), we decided to forego

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body structures to ensure that the resulting ICF-CS reflects those components of the ICF that are not yet in the focus of general physicians.

Study design: As suggested in the ICF-CS development guidelines, randomized controlled trials, clinical controlled trials, cross-sectional studies, observational studies and qualitative studies were included(10). Study protocols, case studies, economic evaluation studies, conference papers, psychometric studies, prevention studies, studies of phase-II clinical trials, studies exclusively showing laboratory parameters, animal experiments, letters, comments and editorials were excluded, as those publications usually do not include relevant information on functioning(10). Furthermore, systematic reviews and meta-analyses were not included in this review.

3.2 Literature search

Electronic searches were carried out in PubMed, PsycINFO, EMBASE, CINAHL und Scopus to identify potentially relevant publications. The search terms were organized into population (e.g. aged, elderly, older adults), living condition (e.g. community-dwelling, independently living) and outcome variables according to the ICF-related terms (e.g. social life, self-care, home environment) using the thesaurus of the respective database (e.g. Medical subject headings in PubMed) as well as free text words. Only studies published between 2007 and 2017 in peer-reviewed journals in English or German were considered for inclusion. The search strategy was reviewed by an experienced librarian. The whole search strategy is available in Appendix A.

3.3 Study selection

The publications found in the databases were exported to a review manager (Covidence). After removing duplicates, five researchers (JT/SHe/SG/SB/EF) performed a title and abstract screening based on the predefined eligibility criteria. Title and abstract of each publication were screened by two researchers independently. As an overwhelming number of publications were identified for the full text screening, a random sample was drawn to ensure manageability. As the purpose of this review was not to answer clinical questions by evaluating existing evidence,

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but only to systematically identify relevant concepts of functioning, drawing a random sample was possible. This procedure has already been applied in previous ICF-CS development projects(20-23) and is also recommended in the guidelines(10). It was decided that a random sample, containing 50% of all publications, should be included for full text screening. The random sample was drawn using the Random Integer Set Generator(24). The full texts were screened by four independent researchers (one half by JT and SHe and the other half by SG and SB) based on the predefined inclusion and exclusion criteria. Results were compared and any disagreement was solved in discussion with all four researchers.

3.4 Assessment of study quality

As the purpose of this review was to systematically identify relevant concepts of functioning and not to assess the effectiveness of certain interventions, a quality assessment of the studies was considered unnecessary. Nevertheless, only studies that were published in peer-reviewed scientific journals were included for analysis. Thus, the publications have assumingly undergone a level of quality control.

3.5 Data extraction

Following the PICOS scheme, the following data were extracted from the publications:

- Population: age, gender, sample size, type of sample (e.g. community-dwelling or residents of independent living facilities)
- Intervention (if applicable)
- Control (if applicable)
- Outcomes: concepts identified in the article text; instruments for assessing functioning
- Study design

Other data extracted were author, title, year and country. “A concept was defined as a single health aspect or a personal (internal) or environmental (external) factor with an impact on health. Formally, a concept could consist of a single word or a set of words”(25). Examples for concepts are living arrangements, social embeddedness or walking. Assessment instruments

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were defined as any kind of standardized outcome measure (e.g. questionnaires, clinical tests) used in the study. The extraction process led to two different data sets: 1) assessment instruments and 2) concepts extracted from the article text. The first data set is more objective as the assessment instruments provide a standardized and systematic basis for further analysis, whereas the second data set is more subjective. Because of this and based on the methodology applied in other ICF-CS development projects, it was decided to focus only on the first data set(26-29). Disagreement between the two researchers regarding the extracted data was solved by discussion. When consensus between the two could not be reached, a third researcher was consulted.

3.6 Data synthesis

Assessment instruments that were not available in the respective publication were accessed either through the internet or by contacting the authors of the included publications. Following the method of other ICF-CS development projects, only assessment instruments used in at least two different studies were considered(30, 31). The items and response options of each assessment instrument were listed on one table. Subsequently, meaningful concepts contained within each item or response option were extracted. The concepts were linked to ICF categories by four independent researchers (one half by JT and SHe and the other half by SG and SB) using established linking rules(32). When consensus between the two researchers was not reached, a third researcher was consulted. If an ICF category was assigned repeatedly in an assessment instrument, it was counted only once. However, when a publication reported on a study that used multiple instruments and a specific category was identified in more than one of these instruments, this particular category was counted according to the number of instruments to which it was linked. Therefore, the maximum count of one category can exceed the number of identified studies included in the review. We used descriptive statistics to report the most frequently identified ICF categories.

Only first-level and second-level ICF categories are reported in this paper.[3] If a concept was linked to a third- or fourth-level ICF category, the overarching second-level category was

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included for analysis. Due to the hierarchical nature of the ICF, a lower-level category shares the attributes of the higher-level category of which it is a member(33).

3.7 Patient and public involvement

Patients and the public were not involved in this study.

4 Results

4.1 Study Selection

A total of 10,043 publications were identified. After removing duplicates, 5,060 potentially relevant publications were left. In the abstract screening 681 articles were identified for full-text screening. Of these, a random sample of 341 articles (50%) was drawn for the full text screening, from which 82 articles were subsequently included for data extraction (see figure 1). The references of the included studies are available in Appendix B and the study characteristics are provided in Appendix C.

Please insert figure 1 here

4.2 Study characteristics

The 82 included studies were conducted in 17 different countries. About 20% of the studies were conducted in Finland (n = 16), 14.6% in Sweden (n = 12) and 12.2% in the United States (n = 10). The investigated study population consisted of 74,351 community-dwelling elderly, of whom 68.6% were female. Three publications did not provide information about the gender of their participants. Most of the studies (65.9%) had an observational design (longitudinal or cross sectional), 15.6% were qualitative studies, 12.2% intervention studies, 4.9% analyzed secondary data and one study (1.2%) used mixed methods.

4.3 Linking Results

From the 82 included publications 111 assessment instruments were identified. Out of these, 30 were identified in at least two of the publications and were included for data extraction (table 1).

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Table 1

Frequency of use and thematic focus of the included assessment instruments.

Assessment instrument (study references: see App. B)	Nr. of studies	Cognition	Mobility	Functioning	status	Environmental	factors	Health conditions
Mini Mental State Examination (MMSE) (1, 3, 5, 8, 10, 12, 18, 21, 22, 28, 45, 46, 50, 51, 52, 54, 55, 56, 58, 63, 65, 66, 71, 72, 74)	25	x						
Geriatric Depression Scale - 15 items (1, 8, 10, 28, 41, 50, 56, 57, 65, 71, 72, 78, 79)	13							x
Lawton Instrumental Activities of Daily Living Scale (6, 8, 15, 21, 22, 38, 39, 40, 48, 50, 57, 68)	12				x			
Katz Index of Independence in Activities of Daily Living (10, 12, 38, 39, 40, 47, 48, 68, 81)	9				x			
Timed up and go (1, 6, 15, 17, 23, 33, 62)	7		x					
Short Physical Performance Battery (18, 28, 32, 35, 36, 43, 55)	7		x					
Activities of Daily Living staircase (24, 25, 27, 34, 41, 79)	6				x			
Short Form Health 36 (11, 17, 19, 23, 31)	5				x			
Geriatric Depression Scale - 30 items (6, 38, 39, 40, 81)	5							x
Barthel Index of Activities of Daily Living (6, 15, 21, 22, 50)	5				x			
Center for Epidemiologic Studies Depression Scale (18, 32, 44, 47, 70)	5							x
The University of Alabama at Birmingham Study of Aging Life-Space Assessment (10, 18, 51, 69)	4						x	
EuroQoL-5 dimension (30, 48, 72, 74)	4				x			
Berg Balance Scale (1, 5, 25)	3		x					
Groningen Activity Restrictions Scale (63, 71, 72)	3				x			
Abbreviated Mental Test Score (38, 39, 40)	3	x						
Minimum Data Set - Home Care (35, 36, 43)	3	x	x		x		x	x
Mobility-Tiredness-Scale (5, 44, 74)	3							
Usability in my Home Questionnaire (34, 41, 79)	3						x	

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Perceived environmental barriers to outdoor mobility (54, 55)	2				x	
Cognitive Performance Scale (35, 43)	2	x				
Functional Independence Measure (61, 62)	2		x	x		x
Gait Speed (2, 15)	2		x			
Gijón Social Scale (15, 22)	2				x	
Housing Enabler Screening Tool (34, 41)	2				x	
Housing Options for Older People (41, 79)	2				x	
Impact on Participation and Autonomy Questionnaire (46, 54)	2		x	x	x	
Instrumental Activity Measure (61, 62)	2			x		
Mini Nutritional Assessment (21, 22)	2		x	x		x
Neuropsychological Aging Inventory (34, 67)	2			x	x	

Note. The numbers in brackets refer to the studies (see Appendix B), in which the instrument was used.

The most frequently used assessment instrument was the Mini Mental State Examination (MMSE), which was reported in 25 articles (31.3%). From the selected assessment instruments 1,182 concepts were extracted. Out of these, 24 concepts were linked to first-level ICF categories, 1,066 to second-level categories and 48 multidimensional concepts to two or more ICF categories. Forty-four concepts could not be assigned to a specific ICF category.

The 1,066 concepts were assigned to 87 different second-level ICF categories (see table 2). Of these, 41 (47.1%) are related to 'activities and participation', 24 (27.6%) categories refer to 'body functions', 20 (23.0%) to 'environmental factors' and two (2.3%) belong to 'body structures'. Mentioned 53 times, the category *memory functions (b144)* was the most frequently identified category. Within the 'activities and participation' component, the category *dressing (d540)* and within the 'environmental factors' component, *products or substances for personal consumption (e110)* were identified most often. The two extracted ICF categories for 'body structures' were *structure of upper extremity (s730)* and *structure of lower extremity*

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(s750). All 87 ICF categories will serve as candidates for consideration for inclusion in the final ICF-CS during the consensus conference.

Table 2

Frequency of second-level ICF categories linked to concepts identified in the assessment instruments.

ICF code	ICF category	Count
Activities and participation		**612**
d177	Making decisions	9
d166	Reading	2
d170	Writing	2
d210	Undertaking a single task	28
d230	Carrying out daily routine	9
d240	Handling stress and other psychological demands	7
d360	Using communication devices and techniques	17
d410	Changing basic body position	39
d450	Walking	36
d470	Using transportation	25
d455	Moving around	24
d460	Moving around in different locations	21
d475	Driving	17
d420	Transferring oneself	15
d430	Lifting and carrying objects	8
d445	Hand and arm use	5
d415	Maintaining a body position	3
d465	Moving around using equipment	2
d540	Dressing	41
d510	Washing oneself	39
d550	Eating	36
d530	Toileting	30
d520	Caring for body parts	13
d560	Drinking	11
d570	Looking after one's health	5
d640	Doing housework	37
d630	Preparing meals	28

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d620	Acquisition of goods and service	28
d650	Caring for household objects	6
d660	Assisting others	2
d750	Informal social relationships	4
d710	Basic interpersonal interactions	2
d720	Complex interpersonal interactions	2
d760	Family relationships	2
d770	Intimate relationships	2
d870	Economic self-sufficiency	17
d850	Remunerative employment	7
d860	Basic economic transactions	2
d920	Recreation and leisure	19
d910	Community life	5
d930	Religion and spirituality	5
Body functions		**359**
b144	Memory functions	53
b114	Orientation functions	35
b140	Attention functions	35
b152	Emotional functions	35
b167	Mental functions of language	30
b130	Energy and drive functions	28
b126	Temperament and personality functions	23
b110	Consciousness functions	5
b134	Sleep functions	5
b160	Thought functions	5
b147	Psychomotor functions	3
b172	Calculation functions	3
b280	Sensation of pain	12
b210	Seeing functions	3
b230	Hearing functions	3
b330	Fluency and rhythm of speech functions	5
b525	Defecation functions	19
b510	Ingestion functions	3
b530	Weight maintenance functions	3

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b620	Urination functions	25
b755	Involuntary movement reaction functions	13
b730	Muscle power functions	7
b810	Protective functions of the skin	3
b820	Repair functions of the skin	3
Body structures		**4**
s750	Structure of lower extremity	2
s730	Structure of upper extremity	2
Environmental factors		**91**
e110	Products or substances for personal consumption	17
e155	Design, construction and building products and technology of buildings for private use	12
e115	Products and technology for personal use in daily living	5
e120	Products and technology for personal indoor and outdoor mobility and transportation	4
e125	Products and technology for communication	2
e160	Products and technology of land development	2
e165	Assets	2
e210	Physical geography	2
e225	Climate	2
e240	Light	2
e250	Sound	2
e310	Immediate family	5
e315	Extended family	5
e320	Friends	5
e325	Acquaintances, peers colleagues, neighbors and community members	5
e355	Health professionals	3
e575	General social support services, systems and policies	5
e580	Health services, systems and policies	5
e530	Utilities services, systems and policies	4
e520	Open space planning services, systems and policies	2
e530	Utilities services, systems and policies	4
e520	Open space planning services, systems and policies	2

Note. d: activities and participation, b: body functions, s: body structures, e: environmental factors

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The assigned first-level categories can be seen in table 3. Forty-eight extracted concepts were not linkable to only one ICF category. For these concepts, two or more categories were chosen for each concept (table 4).

Table 3

Frequency of first-level ICF categories linked to concepts identified in the assessment instruments.

ICF Codes	ICF category	Count
e3	Support and relationships	9
d7	Interpersonal interactions and relationships	5
d3	Communication	2
d4	Mobility	2
d5	Self-care	2
d6	Domestic life	2
d8	Major life areas	2

Note. e: environmental factors, d: activities & participation

Table 4

Frequency of combinations of ICF categories linked to concepts identified in the assessment instruments.

ICF codes	Description	Count
b152, b1266	Feeling worthless	18
b130, b1264	Openness for new experiences	18
b1470, d720, b1521	Changes in behavior symptoms	3
b152, b130	Indicators of depression, anxiety, sad mood	3
b1641, d230, d177	Cognitive skills for daily decision-making	3
b755, b2402, b152	Fear of falling	3

Note. b: body functions, d: activities & participation

Out of the 44 concepts, which could not be assigned to a specific ICF category, 30 (68.2%) were characterized as ‘not definable’ (nd), implying that the concept belonged to the universe of the ICF, but a decision about the most precise ICF category could not be made as the concepts were too broad to be linked to one specific ICF category or a combination of ICF categories(32). Nine (20.5%) concepts referred to ‘personal factors’ (pf) and five (11.4%) were ‘health conditions’ (coded as ‘not covered-health condition’, nc-hc). The ‘nd’ concepts included

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general health (n = 14), physical health (n = 5), physical activity (n = 3), activities of daily living (n = 3) and other (n = 5). Concepts linked to 'personal factors' included living arrangements, self-sufficiency and medication adherence.[4] The commonly reported health conditions according to organ systems were diseases of the skin and subcutaneous tissue, psychiatric disorders, neurological diseases, infectious diseases, diseases of the digestive system, sensory disorders, diseases of the musculoskeletal system, and cancer.

5 Discussion

As part of the project to develop an ICF-CS for community-dwelling adults ≥ 75 years old for use in primary care, this scoping review was performed to identify aspects of functioning that are considered relevant in frequently used assessment instruments published in the scientific literature. From the research perspective, the component 'activities and participation' has shown to be the most relevant among all ICF components with regard to functioning of older patients. Almost half of all assigned categories are in this component. ICF categories that belong to the components 'body functions' and 'environmental factors', were less frequently assigned. With only two ICF categories, 'body structures' seems to be the least relevant component of the four. However, this might be due to the fact that studies which solely focused on body structures without considering any other features of functioning were excluded. Such studies were excluded to help ensure that the resulting ICF-CS goes beyond the biological aspects of health provision and promotes those components of the ICF that might not yet receive enough attention in primary care. It is noteworthy that the ICF-CS for primary care and for the geriatric population developed by the research groups in the Netherlands also did not include body structures(12-14).

The ICF chapters with the most frequently assigned categories were: b1 'mental functions', d4 'mobility', d5 'self-care', and d6 'domestic life'. These areas are of special interest as they are prerequisites for being able to live independently at home. In a meta-analysis, indicators of functional and cognitive impairments were identified as the strongest predictors for necessitating admission to a nursing home(34). Cognitive impairment has also been identified

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as the strongest predictor for necessitating nursing home placement in a study investigating caregivers reasons for nursing home placement(35). Frequently identified categories referring to d5 'self-care' were *dressing (d540), washing oneself (d510), eating (d550),* and *toileting (d530)*. These are all activities of daily living. Literature indicates, that older adults with problems in three or more activities of daily living had a higher risk of being admitted to a nursing home than adults without problems(34). Household activities, like *doing housework (d640)* or *preparing meals (d630),* have frequently been identified in this review, but have not been found to be a major predictor for nursing home placement(34). This might be due to the fact that impairments in these areas can easily be compensated e.g. with household aids or assistance from family members.

No concepts were identified referring to the chapter b4 'functions of the cardiovascular, hematological, immunological and respiratory systems'. This might be due to the fact, that health conditions are coded with 'nc-hc' and not with the ICF category representing the underlying functions affected by a certain disease. Another explanation might be that, although the prevalence of diseases in these systems, especially of cardiovascular diseases, has increased since the 1980s, inability to perform activities of daily living as well as mortality induced by these diseases has decreased in the same period(2). This might be an explanation why recent research that focuses on functioning of the elderly, as reflected by the publications from 2007-2017, is less concerned with functions of the cardiovascular, hematological, immunological and respiratory systems. Moreover, no concepts were identified in the chapter e4 'attitudes'. Attitudes may be more in the focus of qualitative research, which, due to the focus on assessment instruments in this study, did barely show up within this data set. However, as several studies and systematic reviews suggest that negative attitudes towards old age negatively affect the health of the elderly, attitudes might be a relevant aspect to also include in instruments used for assessing functioning(36-38).

Concepts referring to environmental factors with an impact on an individual's life were minimally addressed in the assessment instruments reported in the included articles. The most frequently identified category in this section was *products or substances for personal*

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consumption (e110), mainly assigned for the concept of medication. However, environmental factors like housing design (e.g. lighting conditions, uneven surfaces), neighborhood planning (e.g. public transportation, walkable community services), and social support (e.g. family, friends, or health professionals) play a crucial role in old age. Considering these environmental factors can contribute to the prevention of falls, nursing home placement as well as to the compensation of other negative effects of age-related declines(34, 39-41). Thus, developing instruments that addresses these essential environmental factors or revising current assessment instruments to include more environmental factors items may be warranted.

5.1 Strengths and limitations

There are several strengths and limitations of this scoping review. A broad literature review was performed using a systematic search strategy in five key medical and social databases. One strength is its interdisciplinary nature. The researchers who developed the search strategy and conducted the study selection, data extraction and linking are from different disciplines (e.g. psychology, sports science, medicine), allowing for an interdisciplinary perspective on the topic. Furthermore, this review encompassed a broad spectrum of studies, including cross-sectional and longitudinal studies as well as randomized controlled trials.

A limitation of this literature review is the restriction to articles published in English or. Thus, relevant studies conducted in the selected countries, but published in the authors' native language were possibly missed. Also drawing a random sample for full text screening carries the risk of losing potentially relevant publications. Finally, excluding studies that focus solely on body structures may have introduced some bias in the results. The reason for excluding these studies was mentioned above.

Some potentially relevant information may have been lost in the linking process. While the ICF is too extensive to be used in daily practice, especially in a primary care setting, single ICF categories are often not precise enough to represent some relevant concepts for older adults. For example, fatigue, falls or fear of falling could not easily be linked to one specific ICF category. Sometimes more than one category was necessary to be able to describe these concepts; e.g. fear of falling was linked using *involuntary movement reaction functions (b755)*,

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sensation of falling (b2402), and *emotional functions (b152).* Other concepts could only be linked to the very general first-level ICF categories, not allowing a detailed representation of the concept; e.g. isolation was linked to s*upport and relationships (e3)*. Sometimes, the same concept could be linked to different categories. This was especially the case for concepts regarding the change of body positions. For example the concept "get into bed" can be linked to:

- *lying down (d4100);* defined as *"Getting into and out of a lying down position or changing body position from horizontal to any other position, such as standing up or sitting down"*(33) or to
- *standing (d4104);* defined as *"Getting into and out of a standing position or changing body position from standing to any other position, such as lying down or sitting down"(33).*

This was one reason why we decided to link all concepts to second-level categories only. Being aware of these issues, WHO created a mechanism of updating ICF categories to further enhance the use of this classification(42). We will report the linking problems we faced to WHO after publication of this study.

5.2 Implications for practice

Within a consensus conference a comprehensive ICF-CS based on the results of this scoping review and the three other preparatory studies, and also considering the already existing ICF-CS for this target group mentioned in the introduction, will be developed.

As discussed, several aspects of functioning that were identified in this review are closely linked to independent living. There is some evidence that older patients tend to consider problems in functioning that threaten their independent living as most important, whereas their physicians focus more on somatic problems and risk factors(43). Thus, in order to better balance medical interventions according to the older patients' needs, it might be warranted to include more psychosocial and environmental information in the consultation process(44). Providing physicians with our comprehensive, but easy to handle ICF-CS might be a first step

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towards achieving this. Considering information on functioning might support general practitioners to better estimate the relevance of medical interventions, and thus avoid unnecessary medical interventions.

6 Conclusions

In conclusion, this scoping review demonstrates that frequently used instruments for assessing functioning in older adults focus mainly on activities of daily living and mental functions, whereas environmental factors are only minimally addressed. Despite some limitations experienced in the linking process, the ICF provides a useful reference to identify and cluster the concepts used in instruments for assessing functioning of older adults.

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8 Footnotes

8.1 Contributors

JT was involved in the development of the search strategy; performed the literature search; took part in the screening of the papers, the data extraction and the linking process; performed the data analysis; was involved in the interpretation of the data; drafted parts of the manuscript and collated all sections from the co-authors. SHe was involved in the development of the search strategy, the screening of the papers, the data extraction, the linking process and the interpretation of the data. MS advised the research team on the ICF Core Set methodology and revised the draft. EF was involved in the conception of the study, the development of the search strategy and the abstract screening; provided supervision and revised the draft.

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EG/TK/SHu were involved in the conception of the study and in the development of the search strategy; provided supervision and revised the draft. SB/SG were involved in the development of the search strategy, the screening of the papers, the data extraction, the linking process and the interpretation of the data; drafted parts of the manuscript. All authors read and approved the final version of the manuscript. SB and SG contributed equally to this work.

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8.3 Disclaimer

The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

8.4 Competing interests

None declared.

8.5 Patient consent for publication

Not required.

8.6 Ethics approval

Not required.

8.7 Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

8.8 Notes

[1] A list of accredited ICF-CS can be found here: https://www.icf-core-sets.org/en/page1.php. [2] The ICF Research Branch is a cooperation partner within the WHO collaborating center for the Family of International Classifications (WHO-FIC) in Germany, which aims to promote health by implementing ICF based tools and models.[3] The categories of the ICF are divided into different levels. First-level categories are coded using the component letter (b, s, d, or e)

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followed by the chapter number (one digit). Second-level categories are coded using the letter and three digits; the third- and fourth-level categories using the letter and four or five digits. [4] In the International Classification of Functioning, Disability and Health personal factors are defined as factors related to the individual (e.g. age, gender, life experiences) whereas environmental factors cover all aspects of the external world that have an impact on functioning (e.g. social systems or laws).

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10 List of abbreviations

ICF: International Classification of Functioning, Disability and Health

ICF-CS: International Classification of Functioning, Disability and Health Core Set

PRISMA-Sc: Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews

PICOS: Patients, Intervention, Comparison, Outcomes, Study design

11 List of figures

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

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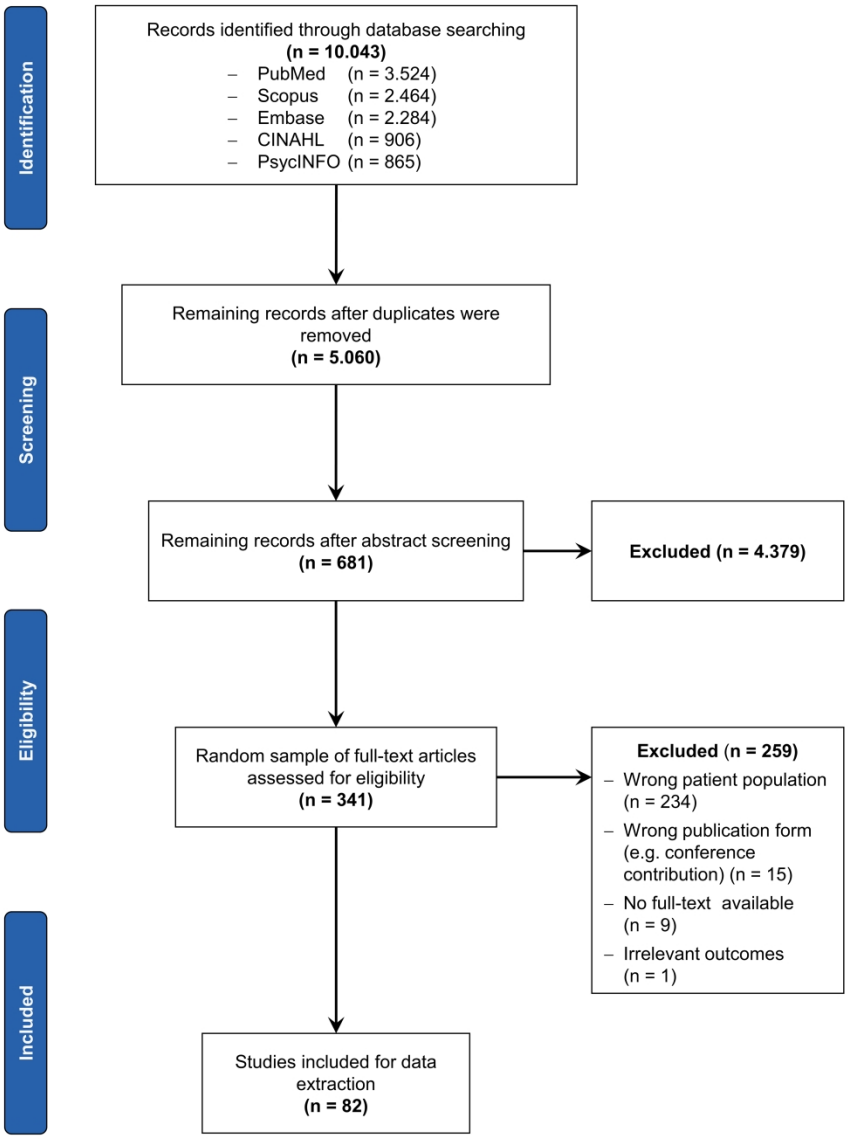

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

169x225mm (600 x 600 DPI)

Appendix A

Search strategy Embase

1. aged/
2. very elderly/
3. aging/
4. "elder*".ab,ti.
5. "senior*".ab,ti.
6. "geriatric*".ab,ti.
7. aging.ab,ti.
8. ageing.ab,ti.
9. "geriatric assessment"/
10. "limited mobility"/
11. "Sickness Impact Profile"/
12. "risk factor"/
13. "independent living"/
14. health/
15. "mental health"/
16. "quality of life"/
17. "women's health"/
18. "men's health"/
19. "health status"/
20. "International Classification of Functioning, Disability and Health"/
21. "community living"/
22. "coping behavior"/
23. disability/
24. "environmental factor"/
25. performance/
26. "physical disability"/
27. "ADL disability"/

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28. "psychologic assessment"/
29. "self care"/
30. "social environment"/
31. "social interaction"/
32. "social life"/
33. "social problem"/
34. "wellbeing"/
35. "abilit*".ab,ti.
36. mobility.ab,ti.
37. "daily routine".ab,ti.
38. "social life".ab,ti.
39. performance.ab,ti.
40. self-care.ab,ti.
41. selfcare.ab,ti.
42. "social interaction".ab,ti.
43. "interpersonal interaction".ab,ti.
44. "coping strategy".ab,ti.
45. "coping strategies".ab,ti.
46. communitydwelling.ab,ti.
47. "community dwelling".ab,ti.
48. "independent living".ab,ti.
49. "independently living".ab,ti.
50. "contextual factor*".ab,ti.
51. "protective factor*".ab,ti.
52. "risk factor*".ab,ti.
53. "personal factor*".ab,ti.
54. "environmental factor*".ab,ti.
55. "living alone".ab,ti.
56. "sociocultural factor*".ab,ti.

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57. "psychosocial factor*".ab,ti.
58. "social environment".ab,ti.
59. "quality of life".ab,ti.
60. well-being.ab,ti.
61. wellbeing.ab,ti.
62. wellness.ab,ti.
63. ICF.ab,ti.
64. "International Classification of Functioning".ab,ti.
65. health.ab,ti.
66. "medical problem*".ab,ti.
67. "psychological problem*".ab,ti.
68. "social problem*".ab,ti.
69. "physical change*".ab,ti.
70. "physical illness".ab,ti.
71. "psychological change*".ab,ti.
72. impairment.ab,ti.
73. "mental change*".ab,ti.
74. "psychological assessment".ab,ti.
75. "cognitive assessment".ab,ti.
76. "needs assessment".ab,ti.
77. "neuropsychological assessment".ab,ti.
78. "behavioural assessment".ab,ti.
79. "behavioral assessment".ab,ti.
80. "social participation".ab,ti.
81. "activities of daily living".ab,ti.
82. "daily living activities".ab,ti.
83. "body function".ab,ti.
84. "body functions".ab,ti.
85. "body structures".ab,ti.

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86. "body structure".ab,ti.

87. "social participation"/

88. "daily life activity"/

89. 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88

90. (English or German).lg.

91. article.pt.

92. ("2007" or "2008" or "2009" or "2010" or "2011" or "2012" or "2013" or "2014" or "2015" or "2016" or "2017").yr.

93. "home environment".ab,ti.

94. "urban environment".ab,ti.

95. disability.ab,ti.

96. disabilities.ab,ti.

97. disable.ab,ti.

98. disabled.ab,ti.

99. disablement.ab,ti.

100. function.ab,ti.

101. functions.ab,ti.

102. functioning.ab,ti.

103. functional.ab,ti.

104. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8

105. 13 or 46 or 47 or 48 or 49 or 93 or 94

106. 9 or 10 or 11 or 12 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103

107. 89 and 104 and 105 and 106

108. 90 and 92 and 107

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Appendix C

Characteristics of included studies

Study	Methods					Demographics			
	Country	Design	Type of intervention (if applicable)	Type of control (if applicable)	Sample size	Type of sample	Age	Female (%)	Included in 1st Dataset
Aartolahti et al. (2013)	Finland	cross-sectional study	multidisciplinary intervention, focused on medication, nutrition, and exercise	n/a	576	community-dwelling	76-100	70.0	X
Abellan et al. (2013)	France	cross-sectional study	n/a	n/a	3,025	community-dwelling	≥75	100.0	X
Ahluwalia et al. (2010)	USA	qualitative study using interviews and grounded theory	n/a	n/a	23	community-dwelling	≥78	61.0	X
Almeida et al. (2015)	Australia	cross-sectional study	n/a	n/a	1,649	community-dwelling	80-93.7	0.0	
Behm et al. (2015)	Sweden	RCT with follow-up after 1 and 2 years	preventive home visit group, senior meeting group	access to the ordinary range of services for older persons	459	community-dwelling	80-97	64.0	X
Berkemeyer et al. (2009)	Germany	cross-sectional study	n/a	n/a	440	community-dwelling	≥75	44.8	X
Blain et al. (2010)	France	longitudinal study	n/a	n/a	1300	community-dwelling	≥75	100.0	

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Bollwein et al. (2013)	Germany	cross-sectional study	n/a	n/a	192	community-dwelling	75-96	64.6	X
Brännström et al. (2013)	Sweden	qualitative study using narrative interviews and phenomenological hermeneutic method	n/a	n/a	7	community-dwelling	79-95	85.7	
Brown et al. (2016)	USA	longitudinal cohort study	n/a	n/a	410	community-dwelling	≥75	57.0	X
Byles et al. (2015)	Australia	cross-sectional study	n/a	n/a	260	community-dwelling	75-80	50.4	X
Calvert et al. (2009)	USA	cross-sectional study	n/a	n/a	306	community-dwelling	≥85	62.0	X
Chipperfield et al. (2008)	Canada	prospective cohort study	n/a	n/a	198	community-dwelling	80-98	63.1	
Dahlin-Ivanoff et al. (2007)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5	
Diez-Ruiz et al. (2016)	Spain	prospective cohort study with 2 years follow-up	n/a	n/a	215	community dwelling	≥75	63.0	X

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Eckerblad et al. (2015)	Sweden	qualitative study using semi-structured interviews and content analysis	n/a	n/a	20	community-dwelling	79-89	80.0	
El-Khoury et al. (2015)	France	RCT	2-year exercise programme of progressive balance retraining in reducing injurious falls, weekly supervised group sessions supplemented by individually prescribed home exercises	brochures about fall prevention, newsletters, four free exercise sessions	706	community-dwelling	75-85	100.0	X
Eronen et al. (2016)	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0	X
Fabre et al. (2007)	USA	population-based cohort study	n/a	n/a	74	community-dwelling	≥90	51.3	X
Fänge et al. (2009)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5	
Formiga et al. (2014)	Spain	longitudinal study	n/a	n/a	167	community-dwelling	≥85	60.5	X
Formiga et al. (2016)	Spain	RCT with 5-year follow-up	falls and malnutrition prevention	general primary care assessment	328	community-dwelling	≥85	61.6	X
Fritel et al. (2013)	France	observational cross-	n/a	n/a	1,942	community-dwelling	75-85	100.0	X

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		sectional study						
Gustafsson et al. (2013)	Sweden	RCT	preventive home visit group, senior meeting group	ordinary range of community services offered by the municipal care for the aged	459	community-dwelling	80-97	64.0	X
Gustafsson et al. (2012)	Sweden	RCT	preventive home visit group, senior meeting group	access to the ordinary range of community services offered by the municipal agency	459	community-dwelling	80-97	64.0	X
Haak et al. (2007)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	40	community-dwelling	80-89	57.5	
Ottenval Hammar et al. (2014)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	11	community-dwelling	84-95	54.5	X
Hegendörfer et al. (2017)	Belgium	prospective, observational, population based cohort study	n/a	n/a	501	community-dwelling	≥80	63.0	X
Heyl & Wahl (2010)	Germany	cross-sectional study	n/a	n/a	271	community-dweeling	75-94	54	
Hoeksema et al. (2017)	Netherlands	cross-sectional study	n/a	n/a	1026	community-dwelling	≥75	59.0	X

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Horgen et al. (2012)	Norway	mixed methods study	n/a	n/a	165	community-dwelling	75	n/a	X
Houston et al. (2011)	USA	secondary analysis of a longitudinal study with 3 years of follow-up	n/a	n/a	988	community-dwelling	77-100	64.5	X
Idland et al. (2013)	Norway	prospective , observational cohort study with 9 years follow-up	n/a	n/a	307 (baseline) 113 (follow-up)	community-dwelling	75-92	100.0	X
Iwarsson et al. (2009)	Sweden, Germany, Latvia	secondary analysis of a longitudinal survey study with 1 year follow-up	n/a	n/a	834	community-dwelling	75-89	79.7	X
Landi et al. (2010a)	Italy	secondary analysis of a prospective cohort study (baseline)	n/a	n/a	357	community-dwelling	≥80	67.0	X
Landi et al. (2010b)	Italy	secondary analysis of a prospective cohort study with 2 years follow-up	n/a	n/a	364 (baseline) 205 (follow-up)	community-dwelling	≥80	67.0	X
Larsson et al. (2009)	Sweden	qualitative study using	n/a	n/a	18	community-dwelling	86-93	55.6	

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		interviews, observations and phenomenological method (Giorgi)							
Laudisio et al. (2013)	Italy	cross-sectional study	n/a	n/a	356	community-dwelling	≥75	54.5	X
Laudisio et al. (2015)	Italy	longitudinal, population-based study with 1-year follow-up	n/a	n/a	342	community-dwelling	≥75	56.0	X
Laudisio et al. (2010)	Italy	cross-sectional study	n/a	n/a	350	community-dwelling	≥75	54.3	X
Lofqvist et al. (2017)	Latvia	secondary analysis of a longitudinal study with 9 years follow-up	n/a	n/a	59	community-dwelling	77-90	90.0	X
Mahler & Sarvimäki (2012)	Denmark	qualitative study using narrative interviews and thematic analysis	n/a	n/a	5	community-dwelling	81-94	100.0	
Mangani et al. (2008)	Italy	secondary analysis of a prospective cohort study	n/a	n/a	364	community-dwelling	≥80	67.0	X

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Mänty et al. (2014)	Denmark, Finland	secondary analysis of a longitudinal study	n/a		n/a	561	community-dwelling	75	55.0	X
Mikkola et al. (2016)	Finland	secondary analysis of a cross sectional and longitudinal study	n/a		n/a	766	community-dwelling	75-90	62.7	X
Mikkola et al. (2015)	Finland	cross-sectional study	n/a		n/a	848	community-dwelling	75-90	62.0	X
Murabito et al. (2008)	USA	secondary analysis of a prospective cohort study	n/a		n/a	830	community-dwelling	79-88	61.4	X
Muscari et al. (2017)	Italy	prospective, longitudinal population-based study with 7 years follow-up	n/a		n/a	500	community-dwelling	85-102	65.8	X
Nitsch et al. (2011)	UK	cross-sectional study	n/a		n/a	2,967	community-dwelling	≥75	59.7	
Nykänen et al. (2013)	Finland	population based randomized comparative study	n/a		n/a	696	community-dwelling	≥75	69.4	X

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Polku et al. (2015)	Finland	prospective cohort study	n/a	n/a	848	community-dwelling	75-90	62.0	X
Portegijs et al. (2016)	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	753	community-dwelling	75-90	64.0	X
Quail et al. (2007)	Canada	secondary analysis of a population-based cohort study	n/a	n/a	508	community-dwelling	75-96	66.9	
Rantakokko et al. (2014)	Finland	secondary analysis of a cross-sectional study (baseline data)	n/a	n/a	847	community-dwelling	75-90	62.0	X
Rantakokko et al. (2016)	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	848 (baseline), 816 (1 year follow-up), 761 (2 years follow-up)	community-dwelling	75-90	62.0	X
Rantz et al. (2015)	USA	secondary analysis of a cross-	living with sensors	living without sensors	133	residents of independent living facility	mean age: 83	64.7	X

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		sectional study							
Rao et al. (2016)	Canada	secondary analysis of a cross-sectional study	n/a	n/a	1,668	community-dwelling	mean age: 82.9 (SD 6.9)	58.0	X
Rapo-Pylkko et al. (2016)	Finland	cross-sectional study	n/a	n/a	106	community-dwelling	75-85	74.0	X
Rasinaho et al. (2006)	Finland	cross-sectional study	n/a	n/a	645	community-dwelling	75-81	74.3	
Richards & Rankaduwa (2008)	Canada	cross-sectional study	n/a	n/a	722	community-dwelling	≥85	N/A	
Rydwik et al. (2010)	Sweden	RCT 24 month follow-up	1) nutritional treatment (individual dietary counseling + 5 group sessions + general physical training advice) 2) physical training (regular physical group training of approx. 1h, twice a week for 12 weeks +general diet advice) 3) Training & nutrition (specific physical training & specific diet counseling/group session education)	general physical training advice & general diet advice	96	community-dwelling	≥75	60.4	X
Rydwik et al. (2008)	Sweden	RCT	1) nutrition (diet counseling/group session	general physical training advice & general diet advice	96	community-dwelling	≥75	60.4	X

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			education + general physical training advice) 2) training (specific physical training + general diet advice) 3) Training & nutrition (specific physical training & specific diet counseling/group session education)						
Sabayan et al. (2012)	Netherlands	population-based prospective follow-up study with cross-sectional and longitudinal analyses	n/a	n/a	572	community-dwelling	≥85	66.8	X
Sallinen et al. (2015)	Finland	qualitative study using thematic interviews and theory-driven content analysis	n/a	n/a	12	residents of service houses	80-92	75.0	
Sampson et al. (2009)	UK	prospective cohort study	n/a	n/a	10,720	community-dwelling	≥75	59.6	X
Savikko et al. (2010)	Finland	cross-sectional study within an RCT	psychosocial group rehabilitation intervention	not named (participants were not considered for analysis)	117	community-dwelling and residents of	75-92	74.0	X

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							independent living facility		
Sixsmith et al. (2014)	Hungary, Latvia, United Kingdom, Germany, and Sweden	qualitative study using in-depth, semi-structured interviews and grounded theory	n/a	n/a	190	community-dwelling	75-89	61.6	X
Thompson et al. (2011)	USA	cross-sectional study	n/a	n/a	27	inhabitants of an independent retirement community	78-94	67.0	X
Tsai et al. (2015)	Finland	cross-sectional study	n/a	n/a	174	community-dwelling	75-90	64.0	X
Tsai et al. (2013)	Finland	cross-sectional study	n/a	n/a	657	community-dwelling	75-81	75.0	X
van Bemmel et al. (2010)	Netherlands	prospective population-based study	n/a	n/a	277	community-dwelling	≥85	72.6	X
van Houwelingen et al. (2015)	Netherlands	cluster RCT	care plan for people with a combination of problems at the functional, somatic, mental, or social level	usual care	2,681 (baseline) 2,172 (follow-up)	community-dwelling	≥75	68.3	X
Vasara (2015)	Finland	qualitative study using semi-structured storylines and	n/a	n/a	14	community dwelling	78-88	64.3	

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		narrative analysis							
Vestergaard et al. (2008)	Denmark	RCT	home-based video exercises; 26min/day; 3 times/week; 5 months; bi-weekly telephone call	bi-weekly telephone call	53	community-dwelling	75-91	100.0	X
von Humboldt & Leal (2015)	Portugal	qualitative study using interviews and qualitative content analysis	n/a	n/a	152	community-dwelling	75-102	61.2	
Wang et al. (2017)	Australia	cross-sectional study	n/a	n/a	81	community-dwelling	mean age: 83.8 (SD 3.83)	44.4	
Werth et al. (2017)	Australia	retrospective cross-sectional survey study	n/a	n/a	239	community-dwelling	≥76	60.7	
Williams et al. (2007)	Australia	cross-sectional study	n/a	n/a	546	community-dwelling	75-96	68.0	X
Wilson et al. (2007)	UK	cross-sectional study	n/a	n/a	242	community-dwelling	80-90	69.9	X
Wong et al. (2010)	Canada	cross-sectional study	n/a	n/a	740	community-dwelling	75-96	68.0	
Young (2009)	USA	prospective cohort study	n/a	n/a	298	people living in the	75-94	69.1	X

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								independent living unit of a continuing care retirement community		
Zingmond et al. (2011)	USA	retrospective cohort study	n/a		n/a		21,310	community-dwelling	≥75	78.0

Note. n/a = not applicable, N/A = not available

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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	p.2
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	p.3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	p.4-5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	p.5, l.46-50
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	p.6, l.8-10
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	p.6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	p.7, l.27-40
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix A
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	p.7-8
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	p.8-9
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	p.8, l.39-50
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	p.8

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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	p.9-10
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	p.10 and figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Appendix C
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	n/a
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	p.11-12 (table 1)
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	p.10-17
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	p.17-19 + 20-21
Limitations	20	Discuss the limitations of the scoping review process.	p.19-20
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	p.21
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	p.22

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

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Laying the foundation for a Core Set of the International Classification of Functioning, Disability and Health for community-dwelling older adults in primary care: Relevant categories of their functioning from the research perspective. A scoping review

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Laying the foundation for a Core Set of the International Classification of Functioning, Disability and Health for community-dwelling older adults in primary care: Relevant categories of their functioning from the research perspective. A scoping review

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Abstract

Objectives: The objective of this study was to find relevant concepts of functioning in community-dwelling older adults within frequently used assessment instruments published in the scientific literature. This was part of a larger project to develop an International Classification of Functioning, Disability and Health (ICF) Core Set for use in primary care.

Design: A scoping review was conducted. Articles dealing with functioning in older adults were searched and assessed for eligibility. The study population included community-dwelling adults (≥ 75 years) without dementia, living in high-resources countries. Relevant concepts were extracted from assessment instruments and linked to the ICF using standardized linking rules. Finally, a frequency analysis was conducted.

Setting: Home, primary care.

Participants: Community-dwelling adults aged 75 years and above.

Results: From 5,060 identified publications 68 were included and 30 assessment instruments extracted. Overall, 1,182 concepts were retrieved. Most were linked to the 'activities and participation' component. The most frequently identified categories were *'memory functions',* *'dressing',* and *'changing basic body position'.*

Conclusions: This review provides a list of relevant ICF categories from the research perspective that will be used for developing an ICF Core Set for older primary care patients.

Trial registration number: PROSPERO (CRD42017067784), *Versorgungsforschung Deutschland Datenbank* [VfD_17_003833] and clinicaltrials.gov [NCT03384732].

Keywords: International Classification of Functioning, Disability and Health, community-dwelling older adults, geriatric health services, primary care

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1 Article Summary

1.1 Strengths and limitations

- A broad literature search was performed in five key medical and social databases.
- This review encompassed a broad spectrum of studies, including mainly cross-sectional and longitudinal studies as well as randomized controlled trials, but also two qualitative and one mixed method study.
- Restricting the search to articles published in English or German in specific high-resources countries and drawing a random sample for full text screening carries the risk of losing potentially relevant publications.
- Excluding studies that focus solely on body structures may have introduced some bias in the results.

2 Introduction

The increasing average life expectancy is accompanied by an increasing prevalence of chronic diseases(1, 2). A blurring between the boundaries of diseases, risk factors and physiological aging processes can be observed(3, 4). In general practices in Germany the prevalence of multimorbidity in patients over the age of 60 is around 85%(5). Multimorbidity is a mostly disease-based concept, which is mainly being responded to pharmaceutically. The prevalence of polypharmacy in general practices in Germany is around 37%(5). Inappropriate polypharmacy can lead to adverse drug events, increased risk for fractures, hospitalization, or even death(6, 7) To address this issue of inappropriate polypharmacy, there is a need for new strategies (e. g. functioning information in the consultation) that consider the complexity of health in older adults. With increasing age, problems in functioning become a strong predictor of mortality and provide important information about the consequences of chronic conditions(8, 9). Making aware of these functioning problems might help shift the medical gaze towards problems and answers more rooted in the patients' lived experience of health, ultimately helping to better balance medical decisions. As general practitioners are the primary contact

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for community-dwelling patients, they could play an important role in advancing the paradigm change from a disease-based to a biopsychosocial view.

Functioning can be defined as the outcome of interactions between a person's health conditions and contextual factors(10). It can be described using the international standard and classification system for describing functioning and health, the International Classification of Functioning, Disability and Health (ICF). With more than 1,400 categories, it is, however, too extensive to be used in daily practice. Thus, shorter lists of categories, so-called ICF Core Sets (ICF-CS), have been developed for several health conditions.[1] They comprise categories relevant to persons living with a specific condition(11). An ICF-CS for geriatric patients in early post-acute rehabilitation was developed in 2005(12). As target group and aims of rehabilitation can differ from that of general medicine, the categories included in this ICF-CS may likewise be different from an ICF-CS for geriatric patients in primary care. Two other ICF-CS, one for primary care and one for geriatric patients, have been developed in the Netherlands(13-15). Though they might turn out to be applicable to our study population, they were developed using methods other than the established multi-perspective methodology for developing ICF-CS, leaving out either the perspective of the target group or the researchers. For this reason, we aimed to develop an ICF-CS for community-dwelling adults (≥ 75 years) for use in primary care, following the standardized process of the ICF Research Branch(11). This process includes a preparatory phase followed by a consensus conference. During the preparatory phase, four studies are conducted to identify relevant ICF categories: a systematic or scoping review (research perspective), a qualitative study (perspective of the target population)(16), an expert survey (experts' perspective), and an empirical study (clinical perspective)(17). To gain a comprehensive understanding of functioning, it is important to capture all four perspectives.

The scoping review reflects the research perspective in that it aims to identify aspects of functioning that are described or evaluated in the scientific literature related to the health condition of interest(11). In this paper, methods and results of the scoping review are presented. The objective was to identify concepts of functioning in community-dwelling older

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adults considered relevant in frequently used assessment instruments published in the scientific literature.

3 Methods

This scoping review was conducted following the methodology proposed by the ICF Research Branch(11).[2] This methodology is composed of five steps: 1) literature search, 2) study selection, 3) extraction of relevant concepts, 4) linkage of the concepts to the ICF and 5) frequency analysis. We did not aim to answer clinical questions by reviewing existing evidence, but to systematically extract the concepts used by the scientific community to operationalize functioning related to community-dwelling older adults. A study protocol has been published elsewhere(18). This review was registered in PROSPERO (CRD42017067784) on 07/10/2017 and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) guideline(19).

3.1 Eligibility Criteria

The selection of the eligibility criteria was guided by the PICOS (Population, Intervention, Comparison, Outcomes, Study design) framework(20). Due to the special focus of this review, only the 'P', 'O', and 'S' were relevant for our search.

Population: For a publication to be included in this review, all the participants included in the published study had to be community-dwelling and at least 75 years old. Studies that included institutionalized participants (e.g. nursing home), participants recruited in a hospital or rehabilitation center, or participants with dementia were excluded. As the intended ICF-CS is meant to be used in primary care practices in Germany, only studies conducted in high-resources countries with a similar socio-economic and cultural background were considered. Consequently, only studies conducted in the member states of the European Union and the European Free Trade Association, the United States, Australia and New Zealand were included. Moreover, to get a representative picture of the health reality of old adults, we excluded studies in which only participants suffering from one specific health condition were included, as these participants might have very specific needs that do not necessarily

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represent the needs of other community-dwelling older adults not suffering from the particular disease.

Outcomes: The publications had to be related to functioning as defined by the ICF (e.g. activities of daily living, social interaction, physical mobility). Publications reporting on studies that solely focused on body structures without considering any other features of functioning were excluded. Since physicians tend to focus on physical aspects of health anyway, and the final ICF-CS is meant to complement this traditional emphasis on physical structures and processes with few categories as necessary (for reasons of feasibility), we decided to forego body structures to ensure that the resulting ICF-CS reflects those components of the ICF that are not yet in the focus of general physicians.

Study design: As suggested in the ICF-CS development guidelines, randomized controlled trials, clinical controlled trials, cross-sectional studies, observational studies and qualitative studies were included(11). Study protocols, case studies, economic evaluation studies, conference papers, psychometric studies, prevention studies, studies of phase-II clinical trials, studies exclusively showing laboratory parameters, animal experiments, letters, comments and editorials were excluded, as those publications usually do not include relevant information on functioning(11). Furthermore, systematic reviews and meta-analyses were not included in this review.

3.2 Literature search

Electronic searches were carried out in PubMed, PsycINFO, EMBASE, CINAHL und Scopus to identify potentially relevant publications. The search terms were organized into population (e.g. aged, elderly, older adults), living condition (e.g. community-dwelling, independently living) and outcome variables according to the ICF-related terms (e.g. social life, self-care, home environment) using the thesaurus of the respective database (e.g. Medical subject headings in PubMed) as well as free text words. Only studies published between 2007 and 2017 in peer-reviewed journals in English or German were considered for inclusion. The search strategy was reviewed by an experienced librarian. The whole search strategy is available in Appendix A.

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3.3 Study selection

The publications found in the databases were exported to a review manager (Covidence). After removing duplicates, five researchers (JT/SHe/SG/SB/EF) performed a title and abstract screening based on the predefined eligibility criteria. Title and abstract of each publication were screened by two researchers independently. As an overwhelming number of publications were identified for the full text screening, a random sample was drawn to ensure manageability. As the purpose of this review was not to answer clinical questions by evaluating existing evidence, but only to systematically identify relevant concepts of functioning, drawing a random sample was possible. This procedure has already been applied in previous ICF-CS development projects(21-24) and is also recommended in the guidelines(11). It was decided that a random sample, containing 50% of all publications, should be included for full text screening. The random sample was drawn using the Random Integer Set Generator(25). The full texts were screened by four independent researchers (one half by JT and SHe and the other half by SG and SB) based on the predefined inclusion and exclusion criteria. Results were compared and any disagreement was solved in discussion with all four researchers.

3.4 Assessment of study quality

As the purpose of this review was to systematically identify relevant concepts of functioning and not to assess the effectiveness of certain interventions, a quality assessment of the studies was considered unnecessary. Nevertheless, only studies that were published in peer-reviewed scientific journals were included for analysis. Thus, the publications have assumingly undergone a level of quality control.

3.5 Data extraction

Following the PICOS scheme, the following data were extracted from the publications:

- Population: age, gender, sample size, type of sample (e.g. community-dwelling or residents of independent living facilities)
- Intervention (if applicable)
- Control (if applicable)

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- Outcomes: concepts identified in instruments for assessing functioning
- Study design

Other data extracted were author, title, year and country. Following the methodology applied in other ICF-CS development projects, it was decided to focus on assessment instruments, as they provide a standardized and systematic basis for further analysis (26-29). “A concept was defined as a single health aspect or a personal (internal) or environmental (external) factor with an impact on health. Formally, a concept could consist of a single word or a set of words”(30). Examples for concepts are living arrangements, social embeddedness or walking. Assessment instruments were defined as any kind of standardized outcome measure (e.g. questionnaires, clinical tests) used in the study. Disagreement between the two researchers regarding the extracted data was solved by discussion. When consensus between the two could not be reached, a third researcher was consulted.

3.6 Data synthesis

Assessment instruments that were not available in the respective publications were accessed either through the internet or by contacting the authors of the included publications. Following the method of other ICF-CS development projects, only assessment instruments used in at least two different studies were considered(31, 32). To give an overview of the identified assessment instruments, they were categorized according to their thematic focus based on the terminology used in the ICF. The items and response options of each assessment instrument were listed on one table. Subsequently, meaningful concepts contained within each item or response option were extracted. The concepts were linked to ICF categories by four independent researchers (one half by JT and SHe and the other half by SG and SB) using established linking rules(33). Concepts that were too broad to be linked to one specific ICF category or a combination of ICF categories were coded as ‘not definable’ (nd), implying that the concept belongs to the universe of the ICF, but a decision about the most precise ICF category could not be made(33). Health conditions were coded as ‘not covered-health

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condition' (nc-hc). To summarize the identified health conditions, they were grouped based on the structure of the International Classification of Diseases(34). Concepts related to the "particular background of an individual's life and living" (e.g. life experiences) were linked to personal factors(10). As there are no codes for these concepts in the ICF they were coded as 'personal factors' (pf).[3] When consensus between the two researchers was not reached, a third researcher was consulted. If an ICF category was assigned repeatedly in an assessment instrument, it was counted only once. However, when a publication reported on a study that used multiple instruments and a specific category was identified in more than one of these instruments, this particular category was counted according to the number of instruments to which it was linked. Therefore, the maximum count of one category can exceed the number of identified studies included in the review. We used descriptive statistics to report the most frequently identified ICF categories. Categories that were frequently identified are assumed to be particularly relevant from the researcher's perspective(11).

Only first-level and second-level ICF categories are reported in this paper.[4] If a concept was linked to a third- or fourth-level ICF category, the overarching second-level category was included for analysis. Due to the hierarchical nature of the ICF, a lower-level category shares the attributes of the higher-level category of which it is a member(10).

3.7 Patient and public involvement

Patients and the public were not involved in this study.

4 Results

4.1 Study Selection

A total of 10,043 publications were identified. After removing duplicates, 5,060 potentially relevant publications were left. In the abstract screening 681 articles were identified for full-text screening. Of these, a random sample of 341 articles (50%) was drawn for the full text screening, from which 68 articles were subsequently included for data extraction (see figure 1). The references of the included studies are available in Appendix B and the study characteristics are provided in Appendix C.

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Please insert figure 1 here

4.2 Study characteristics

The 68 included studies were conducted in 16 different countries. Almost 20% of the studies were conducted in Finland (n = 13), 14.7% in the United States (n = 10) and 10.3% (n = 7) in Sweden and Italy respectively. The investigated study population consisted of 69,718 community-dwelling older adults, of whom 71.0% were female. One publication did not provide information about the gender of the participants. Most of the studies (72.3%) had an observational design (longitudinal or cross sectional), 14.7% were intervention studies, 5.9% analyzed secondary data, 5.6% were qualitative studies and one study (1.5%) used mixed methods.

4.3 Linking Results

From the 68 included publications 111 assessment instruments were identified. Out of these, 30 were identified in at least two of the publications and were included for data extraction (table 1).

Table 1

Frequency of use and thematic focus of the included assessment instruments.

Assessment instrument (study references: see App. B)	Nr. of studies	Cognition	Mobility	Functioning	status	Environmental	factors	Health conditions
Mini Mental State Examination (MMSE) (1, 3, 4, 7, 8, 10, 15, 17,18, 23, 38, 39, 43, 44, 45, 47, 48, 49, 51, 54, 55, 56, 61, 62, 63)	25	x						
Geriatric Depression Scale - 15 items (1, 7, 8, 23, 35, 43, 49, 50, 55, 61, 62, 65, 66)	13							x
Lawton Instrumental Activities of Daily Living Scale (5, 7, 12, 17, 18, 32,33, 34, 41, 43, 50, 58)	12				x			
Katz Index of Independence in Activities of Daily Living (8, 10, 32, 33, 34, 40, 41, 58, 67)	9				x			
Timed up and go (1, 5, 12, 14, 19, 28, 53)	7		x					
Short Physical Performance Battery (15, 23, 27, 30, 31, 36, 48)	7		x					

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Activities of Daily Living staircase (20, 21, 22, 29, 35, 66)	6			x		
Short Form Health 36 (9, 14, 16, 19, 26)	5			x		
Geriatric Depression Scale - 30 items (5, 23, 33, 34, 67)	5					x
Barthel Index of Activities of Daily Living (5, 12, 17, 18, 43)	5			x		
Center for Epidemiologic Studies Depression Scale (15, 27, 37, 40, 60)	5					x
The University of Alabama at Birmingham Study of Aging Life-Space Assessment (8, 15, 44, 59)	4				x	
EuroQoL-5 dimension (25, 41, 62, 63)	4			x		
Berg Balance Scale (1, 4, 21)	3		x			
Groningen Activity Restrictions Scale (54, 61, 62)	3			x		
Abbreviated Mental Test Score (32, 33, 34)	3	x				
Minimum Data Set - Home Care (30, 31, 36)	3	x	x	x	x	x
Mobility-Tiredness-Scale (384, 37, 63)	3					
Usability in my Home Questionnaire (29, 35, 66)	3				x	
Perceived environmental barriers to outdoor mobility (47, 48)	2				x	
Cognitive Performance Scale (30, 36)	2	x				
Functional Independence Measure (52, 53)	2		x	x		x
Gait Speed (2, 12)	2		x			
Gijón Social Scale (12, 18)	2				x	
Housing Enabler Screening Tool (29, 35)	2				x	
Housing Options for Older People (35, 66)	2				x	
Impact on Participation and Autonomy Questionnaire (39, 47)	2		x	x	x	
Instrumental Activity Measure (52, 53)	2			x		
Mini Nutritional Assessment (17, 18)	2		x	x		x
Neuropsychological Aging Inventory (29, 57)	2			x	x	

Note. The numbers in brackets refer to the studies (see Appendix B), in which the instrument was used.

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The most frequently used assessment instrument was the Mini Mental State Examination (MMSE), which was reported in 25 articles (36.8%). From the selected assessment instruments 1,182 concepts were extracted. Out of these, 24 concepts were linked to first-level ICF categories, 1,066 to second-level categories and 48 multidimensional concepts to two or more ICF categories. Forty-four concepts could not be assigned to a specific ICF category.

The 1,066 concepts were assigned to 87 different second-level ICF categories (see table 2). Of these, 41 (47.1%) are related to 'activities and participation', 24 (27.6%) categories refer to 'body functions', 20 (23.0%) to 'environmental factors' and two (2.3%) belong to 'body structures'. Mentioned 53 times, the category *memory functions (b144)* was the most frequently identified category. Within the 'activities and participation' component, the category *dressing (d540)* and within the 'environmental factors' component, *products or substances for personal consumption (e110)* were identified most often. The two extracted ICF categories for 'body structures' were *structure of upper extremity (s730)* and *structure of lower extremity (s750).* All 87 ICF categories will serve as candidates for consideration for inclusion in the final ICF-CS during the consensus conference.

Table 2

Frequency of second-level ICF categories linked to concepts identified in the assessment instruments.

ICF code	ICF category	Count
Activities and participation		**612**
d177	Making decisions	9
d166	Reading	2
d170	Writing	2
d210	Undertaking a single task	28
d230	Carrying out daily routine	9
d240	Handling stress and other psychological demands	7
d360	Using communication devices and techniques	17
d410	Changing basic body position	39
d450	Walking	36
d470	Using transportation	25
d455	Moving around	24

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d460	Moving around in different locations	21
d475	Driving	17
d420	Transferring oneself	15
d430	Lifting and carrying objects	8
d445	Hand and arm use	5
d415	Maintaining a body position	3
d465	Moving around using equipment	2
d540	Dressing	41
d510	Washing oneself	39
d550	Eating	36
d530	Toileting	30
d520	Caring for body parts	13
d560	Drinking	11
d570	Looking after one's health	5
d640	Doing housework	37
d630	Preparing meals	28
d620	Acquisition of goods and service	28
d650	Caring for household objects	6
d660	Assisting others	2
d750	Informal social relationships	4
d710	Basic interpersonal interactions	2
d720	Complex interpersonal interactions	2
d760	Family relationships	2
d770	Intimate relationships	2
d870	Economic self-sufficiency	17
d850	Remunerative employment	7
d860	Basic economic transactions	2
d920	Recreation and leisure	19
d910	Community life	5
d930	Religion and spirituality	5
Body functions		**359**
b144	Memory functions	53
b114	Orientation functions	35
b140	Attention functions	35

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b152	Emotional functions	35
b167	Mental functions of language	30
b130	Energy and drive functions	28
b126	Temperament and personality functions	23
b110	Consciousness functions	5
b134	Sleep functions	5
b160	Thought functions	5
b147	Psychomotor functions	3
b172	Calculation functions	3
b280	Sensation of pain	12
b210	Seeing functions	3
b230	Hearing functions	3
b330	Fluency and rhythm of speech functions	5
b525	Defecation functions	19
b510	Ingestion functions	3
b530	Weight maintenance functions	3
b620	Urination functions	25
b755	Involuntary movement reaction functions	13
b730	Muscle power functions	7
b810	Protective functions of the skin	3
b820	Repair functions of the skin	3
Body structures		**4**
s750	Structure of lower extremity	2
s730	Structure of upper extremity	2
Environmental factors		**91**
e110	Products or substances for personal consumption	17
e155	Design, construction and building products and technology of buildings for private use	12
e115	Products and technology for personal use in daily living	5
e120	Products and technology for personal indoor and outdoor mobility and transportation	4
e125	Products and technology for communication	2
e160	Products and technology of land development	2
e165	Assets	2
e210	Physical geography	2
e225	Climate	2

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e240	Light	2
e250	Sound	2
e310	Immediate family	5
e315	Extended family	5
e320	Friends	5
e325	Acquaintances, peers colleagues, neighbors and community members	5
e355	Health professionals	3
e575	General social support services, systems and policies	5
e580	Health services, systems and policies	5
e530	Utilities services, systems and policies	4
e520	Open space planning services, systems and policies	2
e530	Utilities services, systems and policies	4
e520	Open space planning services, systems and policies	2

Note. d: activities and participation, b: body functions, s: body structures, e: environmental factors

The assigned first-level categories can be seen in table 3. Forty-eight extracted concepts were not linkable to only one ICF category. For these concepts, two or more categories were chosen for each concept (table 4).

Table 3

Frequency of first-level ICF categories linked to concepts identified in the assessment instruments.

ICF Codes	ICF category	Count
e3	Support and relationships	9
d7	Interpersonal interactions and relationships	5
d3	Communication	2
d4	Mobility	2
d5	Self-care	2
d6	Domestic life	2
d8	Major life areas	2

Note. e: environmental factors, d: activities & participation

Table 4

Frequency of combinations of ICF categories linked to concepts identified in the assessment instruments.

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ICF codes	Description	Count
b152, b1266	Feeling worthless	18
b130, b1264	Openness for new experiences	18
b1470, d720, b1521	Changes in behavior symptoms	3
b152, b130	Indicators of depression, anxiety, sad mood	3
b1641, d230, d177	Cognitive skills for daily decision-making	3
b755, b2402, b152	Fear of falling	3

Note. b: body functions, d: activities & participation

Out of the 44 concepts, which could not be assigned to a specific ICF category, 30 (68.2%) were characterized as 'not definable' (nd), (33) nine (20.5%) referred to 'personal factors' (pf) and five (11.4%) were 'health conditions'. The 'nd' concepts included general health (n = 14), physical health (n = 5), physical activity (n = 3), activities of daily living (n = 3) and other (n = 5). Concepts linked to 'personal factors' included living arrangements, self-sufficiency and medication adherence. The commonly reported health conditions were diseases of the skin and subcutaneous tissue, psychiatric disorders, neurological diseases, infectious diseases, diseases of the digestive system, sensory disorders, diseases of the musculoskeletal system, and cancer.

5 Discussion

As part of the project to develop an ICF-CS for community-dwelling adults ≥ 75 years old for use in primary care, this scoping review was performed to identify concepts of functioning that are considered relevant in frequently used assessment instruments published in the scientific literature. From this research perspective, the component 'activities and participation' has shown to be the most relevant among all ICF components with regard to functioning of older patients. Almost half of all assigned categories are in this component. ICF categories that belong to the components 'body functions' and 'environmental factors', were less frequently assigned. From the content of the assessment instruments only four concepts were linked to two ICF categories of the component 'body structures'. Thus, this component was by far the least linked component. However, this might be due to the fact that studies which solely

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focused on body structures without considering any other features of functioning were excluded. As mentioned before, such studies were excluded to help ensure that the resulting ICF-CS goes beyond the biological aspects of health provision and promotes those components of the ICF that might not yet receive enough attention in primary care. It is noteworthy that the ICF-CS for primary care and for the geriatric population developed by the research groups in the Netherlands also did not include body structures(13-15).

The ICF chapters with the most frequently assigned categories were: b1 'mental functions', d4 'mobility', d5 'self-care', and d6 'domestic life'. These areas are of special interest as they are prerequisites for being able to live independently at home. In a meta-analysis, indicators of functional and cognitive impairments were identified as the strongest predictors for necessitating admission to a nursing home(35). Cognitive impairment has also been identified as the strongest predictor for necessitating nursing home placement in a study investigating caregivers reasons for nursing home placement(36). Frequently identified categories referring to d5 'self-care' were *dressing (d540), washing oneself (d510), eating (d550),* and *toileting (d530)*. These are all activities of daily living. Literature indicates, that older adults with problems in three or more activities of daily living had a higher risk of being admitted to a nursing home than adults without problems(35). Household activities, like *doing housework (d640)* or *preparing meals (d630),* have frequently been identified in this review, but have not been found to be a major predictor for nursing home placement(35). This might be due to the fact that impairments in these areas can easily be compensated e.g. with household aids or assistance from family members.

No concepts were identified referring to the chapter b4 'functions of the cardiovascular, hematological, immunological and respiratory systems'. This might be due to the fact, that health conditions are coded with 'nc-hc' and not with the ICF category representing the underlying functions affected by a certain disease. Another explanation might be that, although the prevalence of diseases in these systems, especially of cardiovascular diseases, has increased since the 1980s, inability to perform activities of daily living as well as mortality induced by these diseases has decreased in the same period(2). This might be an explanation

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why recent research that focuses on functioning of older adults, as reflected by the publications from 2007-2017, is less concerned with functions of the cardiovascular, hematological, immunological and respiratory systems. Moreover, no concepts were identified in the chapter e4 'attitudes'. Attitudes may be more in the focus of qualitative research, which, due to the focus of this review on assessment instruments, did barely show up. However, as several studies and systematic reviews suggest that negative attitudes towards old age negatively affect the health of the older persons, attitudes might be a relevant aspect to also include in instruments used for assessing functioning(37-39).

Concepts referring to environmental factors with an impact on an individual's life were minimally addressed in the assessment instruments reported in the included articles. The most frequently identified category in this section was *products or substances for personal consumption (e110),* mainly assigned for the concept of medication. However, environmental factors like housing design (e.g. lighting conditions, uneven surfaces), neighborhood planning (e.g. public transportation, walkable community services), and social support (e.g. family, friends, or health professionals) play a crucial role in old age. Considering these environmental factors can contribute to the prevention of falls, nursing home placement as well as to the compensation of other negative effects of age-related declines(35, 40-42). Thus, developing instruments that addresses these essential environmental factors or revising current assessment instruments to include more environmental factors items may be warranted.

5.1 Strengths and limitations

There are several strengths and limitations of this scoping review. A broad literature review was performed using a systematic search strategy in five key medical and social databases. This review encompassed a broad spectrum of studies, including cross-sectional and longitudinal studies as well as randomized controlled trials. However, due to the focus on assessment instruments, qualitative studies, which have the potential to analyze participants' feelings, opinions, and experiences in-depth, are underrepresented in this study.

Another limitation of this literature review is the restriction to articles published in English or. Thus, relevant studies conducted in the selected countries, but published in the authors' native

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language were possibly missed. Also drawing a random sample for full text screening carries the risk of losing potentially relevant publications. Finally, excluding studies that focus solely on body structures may have introduced some bias in the results. The reason for excluding these studies was mentioned above.

Some potentially relevant information may have been lost in the linking process, as single ICF categories are often not precise enough to represent some relevant concepts for older adults. For example, fatigue, falls or fear of falling could not easily be linked to one specific ICF category. Sometimes more than one category was necessary and still the concept might not be adequately described; e.g. fear of falling was linked using *involuntary movement reaction functions (b755)*, *sensation of falling (b2402),* and *emotional functions (b152)*. Other concepts could only be linked to the very general first-level ICF categories, not allowing a detailed representation of the concept; e.g. isolation was linked to s*upport and relationships (e3)*. Sometimes, the same concept could be linked to different categories. This was especially the case for concepts regarding the change of body positions. For example, the concept "get into bed" can be linked to:

- *lying down (d4100);* defined as *"Getting into and out of a lying down position or changing body position from horizontal to any other position, such as standing up or sitting down"*(10) or to
- *standing (d4104);* defined as *"Getting into and out of a standing position or changing body position from standing to any other position, such as lying down or sitting down"(10).*

This was one reason why we decided to link all concepts to second-level categories only. Being aware of these issues, WHO created a mechanism of updating ICF categories to further enhance the use of this classification(43). We will report the linking problems we faced to WHO after publication of this study.

5.2 Implications for practice

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Within a consensus conference a comprehensive ICF-CS based on the results of this scoping review and the three other preparatory studies, and also considering the already existing ICF-CS for this target group mentioned in the introduction, will be developed.

As discussed, several aspects of functioning that were identified in this review are closely linked to independent living. There is some evidence that older patients tend to consider problems in functioning that threaten their independent living as most important, whereas their physicians focus more on somatic problems and risk factors(44). Thus, in order to better balance medical interventions according to the older patients' needs, it might be warranted to include more psychosocial and environmental information in the consultation process(45). Defining those aspects of functioning that are relevant from the research perspective seems important to us, because assessment instruments that are frequently used influence whether an intervention is seen to be effective or not. The concepts found therefore will have a strong influence on the final ICF-CS to be developed.

6 Conclusions

In conclusion, this scoping review demonstrates that frequently used instruments for assessing functioning in older adults focus mainly on activities of daily living and mental functions, whereas environmental factors are only minimally addressed. Despite some limitations experienced in the linking process, the ICF provides a useful reference to identify and cluster the concepts used in assessment instruments focusing on functioning in community-dwelling older adults.

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8 Footnotes

8.1 Contributors

JT was involved in the development of the search strategy; performed the literature search; took part in the screening of the papers, the data extraction and the linking process; performed the data analysis; was involved in the interpretation of the data; drafted parts of the manuscript and collated all sections from the co-authors. SHe was involved in the development of the search strategy, the screening of the papers, the data extraction, the linking process and the interpretation of the data. MS advised the research team on the ICF Core Set methodology and revised the draft. EF was involved in the conception of the study, the development of the search strategy and the abstract screening; provided supervision and revised the draft. EG/TK/SHu were involved in the conception of the study and in the development of the search strategy; provided supervision and revised the draft. SB/SG were involved in the development of the search strategy, the screening of the papers, the data extraction, the linking process and the interpretation of the data; drafted parts of the manuscript. All authors read and approved the final version of the manuscript. SB and SG contributed equally to this work.

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8.3 Disclaimer

The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

8.4 Competing interests

None declared.

8.5 Patient consent for publication

Not required.

8.6 Ethics approval

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Not required.

8.7 Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

8.8 Notes

[1] A list of accredited ICF-CS can be found here: https://www.icf-core-sets.org/en/page1.php. [2] The ICF Research Branch is a cooperation partner within the WHO collaborating center for the Family of International Classifications (WHO-FIC) in Germany, which aims to promote health by implementing ICF based tools and models.[3] In the International Classification of Functioning, Disability and Health personal factors are defined as factors related to the individual (e.g. age, gender, life experiences) whereas environmental factors cover all aspects of the external world that have an impact on functioning (e.g. social systems or laws). [4] The categories of the ICF are divided into different levels. First-level categories are coded using the component letter (b, s, d, or e) followed by the chapter number (one digit). Second-level categories are coded using the letter and three digits; the third- and fourth-level categories using the letter and four or five digits.

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10 List of abbreviations

ICF: International Classification of Functioning, Disability and Health

ICF-CS: International Classification of Functioning, Disability and Health Core Set

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PRISMA-Sc: Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews

PICOS: Patients, Intervention, Comparison, Outcomes, Study design

11 List of figures

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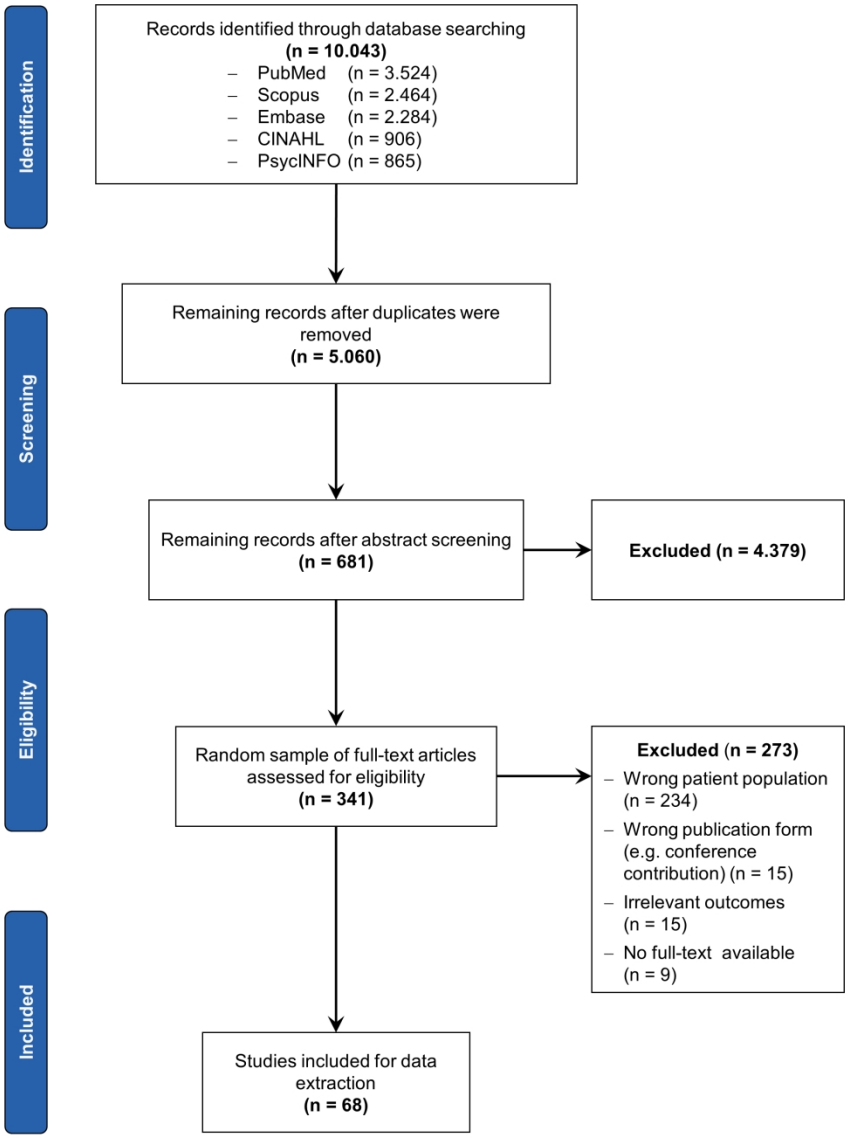

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

190x254mm (300 x 300 DPI)

Appendix A

Search strategy Embase

1. aged/
2. very elderly/
3. aging/
4. "elder*".ab,ti.
5. "senior*".ab,ti.
6. "geriatric*".ab,ti.
7. aging.ab,ti.
8. ageing.ab,ti.
9. "geriatric assessment"/
10. "limited mobility"/
11. "Sickness Impact Profile"/
12. "risk factor"/
13. "independent living"/
14. health/
15. "mental health"/
16. "quality of life"/
17. "women's health"/
18. "men's health"/
19. "health status"/
20. "International Classification of Functioning, Disability and Health"/
21. "community living"/
22. "coping behavior"/
23. disability/
24. "environmental factor"/
25. performance/
26. "physical disability"/
27. "ADL disability"/

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28. "psychologic assessment"/
29. "self care"/
30. "social environment"/
31. "social interaction"/
32. "social life"/
33. "social problem"/
34. "wellbeing"/
35. "abilit*".ab,ti.
36. mobility.ab,ti.
37. "daily routine".ab,ti.
38. "social life".ab,ti.
39. performance.ab,ti.
40. self-care.ab,ti.
41. selfcare.ab,ti.
42. "social interaction".ab,ti.
43. "interpersonal interaction".ab,ti.
44. "coping strategy".ab,ti.
45. "coping strategies".ab,ti.
46. communitydwelling.ab,ti.
47. "community dwelling".ab,ti.
48. "independent living".ab,ti.
49. "independently living".ab,ti.
50. "contextual factor*".ab,ti.
51. "protective factor*".ab,ti.
52. "risk factor*".ab,ti.
53. "personal factor*".ab,ti.
54. "environmental factor*".ab,ti.
55. "living alone".ab,ti.
56. "sociocultural factor*".ab,ti.

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57. "psychosocial factor*".ab,ti.
58. "social environment".ab,ti.
59. "quality of life".ab,ti.
60. well-being.ab,ti.
61. wellbeing.ab,ti.
62. wellness.ab,ti.
63. ICF.ab,ti.
64. "International Classification of Functioning".ab,ti.
65. health.ab,ti.
66. "medical problem*".ab,ti.
67. "psychological problem*".ab,ti.
68. "social problem*".ab,ti.
69. "physical change*".ab,ti.
70. "physical illness".ab,ti.
71. "psychological change*".ab,ti.
72. impairment.ab,ti.
73. "mental change*".ab,ti.
74. "psychological assessment".ab,ti.
75. "cognitive assessment".ab,ti.
76. "needs assessment".ab,ti.
77. "neuropsychological assessment".ab,ti.
78. "behavioural assessment".ab,ti.
79. "behavioral assessment".ab,ti.
80. "social participation".ab,ti.
81. "activities of daily living".ab,ti.
82. "daily living activities".ab,ti.
83. "body function".ab,ti.
84. "body functions".ab,ti.
85. "body structures".ab,ti.

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86. "body structure".ab,ti.

87. "social participation"/

88. "daily life activity"/

89. 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88

90. (English or German).lg.

91. article.pt.

92. ("2007" or "2008" or "2009" or "2010" or "2011" or "2012" or "2013" or "2014" or "2015" or "2016" or "2017").yr.

93. "home environment".ab,ti.

94. "urban environment".ab,ti.

95. disability.ab,ti.

96. disabilities.ab,ti.

97. disable.ab,ti.

98. disabled.ab,ti.

99. disablement.ab,ti.

100. function.ab,ti.

101. functions.ab,ti.

102. functioning.ab,ti.

103. functional.ab,ti.

104. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8

105. 13 or 46 or 47 or 48 or 49 or 93 or 94

106. 9 or 10 or 11 or 12 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103

107. 89 and 104 and 105 and 106

108. 90 and 92 and 107

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Appendix B

References for included articles

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Appendix C

Characteristics of included studies

Study	Methods					Demographics		
	Country	Design	Type of intervention (if applicable)	Type of control (if applicable)	Sample size	Type of sample	Age	Female (%)
Aartolahti et al. (2013)	Finland	cross-sectional study	multidisciplinary intervention, focused on medication, nutrition, and exercise	n/a	576	community-dwelling	76-100	70.0
Abellan et al. (2013)	France	cross-sectional study	n/a	n/a	3,025	community-dwelling	≥75	100.0
Ahluwalia et al. (2010)	USA	qualitative study using interviews and grounded theory	n/a	n/a	23	community-dwelling	≥78	61.0
Behm et al. (2015)	Sweden	RCT with follow-up after 1 and 2 years	preventive home visit group, senior meeting group	access to the ordinary range of services for older persons	459	community-dwelling	80-97	64.0
Berkemeyer et al. (2009)	Germany	cross-sectional study	n/a	n/a	440	community-dwelling	≥75	44.8
Blain et al. (2010)	France	longitudinal study	n/a	n/a	1300	community-dwelling	≥75	100.0
Bollwein et al. (2013)	Germany	cross-sectional study	n/a	n/a	192	community-dwelling	75-96	64.6
Brown et al. (2016)	USA	longitudinal cohort study	n/a	n/a	410	community-dwelling	≥75	57.0

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Byles et al. (2015)	Australia	cross-sectional study	n/a	n/a	260	community-dwelling	75-80	50.4
Calvert et al. (2009)	USA	cross-sectional study	n/a	n/a	306	community-dwelling	≥85	62.0
Chipperfield et al. (2008)	Canada	prospective cohort study	n/a	n/a	198	community-dwelling	80-98	63.1
Diez-Ruiz et al. (2016)	Spain	prospective cohort study with 2 years follow-up	n/a	n/a	215	community dwelling	≥75	63.0
Eckerblad et al. (2015)	Sweden	qualitative study using semi-structured interviews and content analysis	n/a	n/a	20	community-dwelling	79-89	80.0
El-Khoury et al. (2015)	France	RCT	2-year exercise programme of progressive balance retraining in reducing injurious falls, weekly supervised group sessions supplemented by individually prescribed home exercises	brochures about fall prevention, newsletters, four free exercise sessions	706	community-dwelling	75-85	100.0
Eronen et al. (2016)	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0
Fabre et al. (2007)	USA	population-based cohort study	n/a	n/a	74	community-dwelling	≥90	51.3

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Formiga et al. (2014)	Spain	longitudinal study	n/a	n/a	167	community-dwelling	≥85	60.5
Formiga et al. (2016)	Spain	RCT with 5-year follow-up	falls and malnutrition prevention	general primary care assessment	328	community-dwelling	≥85	61.6
Fritel et al. (2013)	France	observational cross-sectional study	n/a	n/a	1,942	community-dwelling	75-85	100.0
Gustafsson et al. (2013)	Sweden	RCT	preventive home visit group, senior meeting group	ordinary range of community services offered by the municipal care for the aged	459	community-dwelling	80-97	64.0
Gustafsson et al. (2012)	Sweden	RCT	preventive home visit group, senior meeting group	access to the ordinary range of community services offered by the municipal agency	459	community-dwelling	80-97	64.0
Hammar et al. (2014)	Sweden	qualitative study using interviews and grounded theory	n/a	n/a	11	community-dwelling	84-95	54.5
Hegendörfer et al. (2017)	Belgium	prospective, observational, population based cohort study	n/a	n/a	501	community-dwelling	≥80	63.0
Heyl & Wahl (2010)	Germany	cross-sectional study	n/a	n/a	271	community-dweeling	75-94	54

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Hoeksema et al. (2017)	Netherlands	cross-sectional study	n/a		n/a	1026	community-dwelling	≥75	59.0
Horgen et al. (2012)	Norway	mixed methods study	n/a		n/a	165	community-dwelling	75	n/a
Houston et al. (2011)	USA	secondary analysis of a longitudinal study with 3 years of follow-up	n/a		n/a	988	community-dwelling	77-100	64.5
Idland et al. (2013)	Norway	prospective , observational cohort study with 9 years follow-up	n/a		n/a	307 (baseline) 113 (follow-up)	community-dwelling	75-92	100.0
Iwarsson et al. (2009)	Sweden, Germany, Latvia	secondary analysis of a longitudinal survey study with 1 year follow-up	n/a		n/a	834	community-dwelling	75-89	79.7
Landi et al. (2010a)	Italy	secondary analysis of a prospective cohort study (baseline)	n/a		n/a	357	community-dwelling	≥80	67.0
Landi et al. (2010b)	Italy	secondary analysis of a prospective cohort study	n/a		n/a	364 (baseline) 205 (follow-up)	community-dwelling	≥80	67.0

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		with 2 years follow-up						
Laudisio et al. (2013)	Italy	cross-sectional study	n/a	n/a	356	community-dwelling	≥75	54.5
Laudisio et al. (2015)	Italy	longitudinal, population-based study with 1-year follow-up	n/a	n/a	342	community-dwelling	≥75	56.0
Laudisio et al. (2010)	Italy	cross-sectional study	n/a	n/a	350	community-dwelling	≥75	54.3
Lofqvist et al. (2017)	Latvia	secondary analysis of a longitudinal study with 9 years follow-up	n/a	n/a	59	community-dwelling	77-90	90.0
Mangani et al. (2008)	Italy	secondary analysis of a prospective cohort study	n/a	n/a	364	community-dwelling	≥80	67.0
Mänty et al. (2014)	Denmark, Finland	secondary analysis of a longitudinal study	n/a	n/a	561	community-dwelling	75	55.0
Mikkola et al. (2016)	Finland	secondary analysis of a cross sectional and	n/a	n/a	766	community-dwelling	75-90	62.7

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		longitudinal study						
Mikkola et al. (2015)	Finland	cross-sectional study	n/a	n/a	848	community-dwelling	75-90	62.0
Murabito et al. (2008)	USA	secondary analysis of a prospective cohort study	n/a	n/a	830	community-dwelling	79-88	61.4
Muscari et al. (2017)	Italy	prospective, longitudinal population-based study with 7 years follow-up	n/a	n/a	500	community-dwelling	85-102	65.8
Nitsch et al. (2011)	UK	cross-sectional study	n/a	n/a	2,967	community-dwelling	≥75	59.7
Nykänen et al. (2013)	Finland	population based randomized comparative study	n/a	n/a	696	community-dwelling	≥75	69.4
Polku et al. (2015)	Finland	prospective cohort study	n/a	n/a	848	community-dwelling	75-90	62.0
Portegijs et al. (2016)	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	753	community-dwelling	75-90	64.0

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Quail et al. (2007)	Canada	secondary analysis of a population-based cohort study	n/a	n/a	508	community-dwelling	75-96	66.9
Rantakokko et al. (2014)	Finland	secondary analysis of a cross-sectional study (baseline data)	n/a	n/a	847	community-dwelling	75-90	62.0
Rantakokko et al. (2016)	Finland	secondary analysis of a cross-sectional study (baseline data & follow-up)	n/a	n/a	848 (baseline), 816 (1 year follow-up), 761 (2 years follow - up)	community-dwelling	75-90	62.0
Rantz et al. (2015)	USA	secondary analysis of a cross-sectional study	living with sensors	living without sensors	133	residents of independent living facility	mean age: 83	64.7
Rao et al. (2016)	Canada	secondary analysis of a cross-sectional study	n/a	n/a	1,668	community-dwelling	mean age: 82.9 (SD 6.9)	58.0
Rapo-Pylkko et al. (2016)	Finland	cross-sectional study	n/a	n/a	106	community-dwelling	75-85	74.0

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Rydwik et al. (2010)	Sweden	RCT 24 month follow-up	1) nutritional treatment (individual dietary counseling + 5 group sessions + general physical training advice) 2) physical training (regular physical group training of approx. 1h, twice a week for 12 weeks +general diet advice) 3) Training & nutrition (specific physical training & specific diet counseling/group session education)	general physical training advice & general diet advice	96	community-dwelling	≥75	60.4
Rydwik et al. (2008)	Sweden	RCT	1) nutrition (diet counseling/group session education + general physical training advice) 2) training (specific physical training + general diet advice) 3) Training & nutrition (specific physical training & specific diet counseling/group session education)	general physical training advice & general diet advice	96	community-dwelling	≥75	60.4
Sabayan et al. (2012)	Netherlands	population-based prospective follow-up study with cross-sectional and longitudinal analyses	n/a	n/a	572	community-dwelling	≥85	66.8
Sampson et al. (2009)	UK	prospective cohort study	n/a	n/a	10,720	community-dwelling	≥75	59.6

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Savikko et al. (2010)	Finland	cross-sectional study within an RCT	psychosocial group rehabilitation intervention	not named (participants were not considered for analysis)	117	community-dwelling and residents of independent living facility	75-92	74.0
Sixsmith et al. (2014)	Hungary, Latvia, United Kingdom, Germany, and Sweden	qualitative study using in-depth, semi-structured interviews and grounded theory	n/a	n/a	190	community-dwelling	75-89	61.6
Thompson et al. (2011)	USA	cross-sectional study	n/a	n/a	27	inhabitants of an independent retirement community	78-94	67.0
Tsai et al. (2015)	Finland	cross-sectional study	n/a	n/a	174	community-dwelling	75-90	64.0
Tsai et al. (2013)	Finland	cross-sectional study	n/a	n/a	657	community-dwelling	75-81	75.0
van Bemmel et al. (2010)	Netherlands	prospective population-based study	n/a	n/a	277	community-dwelling	≥85	72.6
van Houwelingen et al. (2015)	Netherlands	cluster RCT	care plan for people with a combination of problems at the functional, somatic, mental, or social level	usual care	2,681 (baseline) 2,172 (follow-up)	community-dwelling	≥75	68.3

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Vestergaard et al. (2008)	Denmark	RCT	home-based video exercises; 26min/day; 3 times/week; 5 months; bi-weekly telephone call	bi-weekly telephone call	53	community-dwelling	75-91	100.0
Wang et al. (2017)	Australia	cross-sectional study	n/a	n/a	81	community-dwelling	mean age: 83.8 (SD 3.83)	44.4
Williams et al. (2007)	Australia	cross-sectional study	n/a	n/a	546	community-dwelling	75-96	68.0
Wilson et al. (2007)	UK	cross-sectional study	n/a	n/a	242	community-dwelling	80-90	69.9
Young (2009)	USA	prospective cohort study	n/a	n/a	298	people living in the independent living unit of a continuing care retirement community	75-94	69.1
Zingmond et al. (2011)	USA	retrospective cohort study	n/a	n/a	21,310	community-dwelling	≥75	78.0

Note. n/a = not applicable, N/A = not available

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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	p.2
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	p.3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	p.4-6
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	p.5, l.59-p.6, l.5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	p.6, l.22-24
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	p.6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	p.7, l.44
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix A
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	p.8
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	p.8-9
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	p.8, l.53-p.9, l.5
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	p.8

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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	p.9-10
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	p.10 and figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Appendix C
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	n/a
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	p.11-12 (table 1)
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	p.11-17
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	p.17-19 + 21
Limitations	20	Discuss the limitations of the scoping review process.	p.18-19
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	p.21
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	p.22

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).
‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

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